Science Wonder Stories

March

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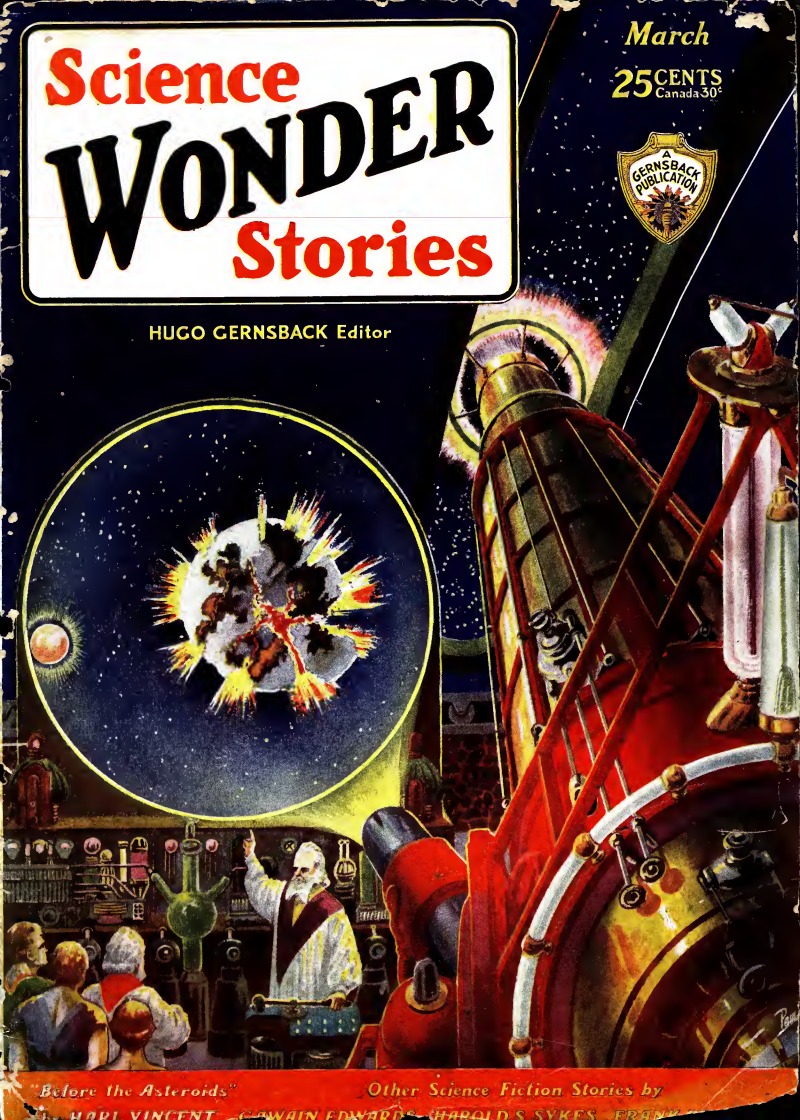

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MARCH, 1930

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ON THE COVER

this month is shown an episode from "Before the Asteroids." The aged Arinian scientist, Andites, is in the act of breaking up the enemy planet Voris by shooting an enormous power across space to disintegrate the atoms of Voris. Beside Andites are the leaders of the armies defending Arin against the enemy.

NEXT MONTH

THE EVENING STAR, by Dr. David H. Keller. Dr. Keller gives us now the promised sequel to his remarkable story, "The Conquerors." As we remember, at the end of "The Conquerors," the people of the earth had been saved temporarily, yet the danger of extinction still hung over them. In this story, Dr. Keller shows in his own inimitable manner the continuance of the efforts of Sir Harry Brunton to preserve the earthlings from the wrath of "The Conquerors."

THE RETURN TO SUBTERRANIA, By Harl Vincent. Those of our readers who read, "The Menace from Below," have clamored for a sequel to this story. Mr. Vincent's picturization of the great hole, within the earth, in which existed many strange creatures, and ruled over by two iron-willed scientists, attracted considerable attention. In the sequel, an exceedingly well written and exciting story, we learn immensely more about that mysterious place called, "Subterrania."

AN ADVENTURE INTO TIME, By Francis Flagg. The versatile author of "The Land of the Bipos" gives us another one of his imaginative creations. Since we printed "The Time Oscillator," several months ago, we have had a perfect flood of letters on various phases of the time traveling question; and surely it is one of the most interesting and intriguing questions of the day. Can man really travel into time, and, if so, how will he do it, and what might he find? Mr. Flagg answers some of these questions in his own remarkable manner.

PRIZE CONTEST STORIES—The three stories receiving Honorable Mention in the November 1929 Cover Prize Contest, will be published. These stories, we have, of course, purchased from the authors at our regular space rates.

AND OTHERS.

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• • • • • Prophetic Fiction is the Mother of Scientific Fact • • • • •

THE RESULTS OF THE $300.00 PRIZE CONTEST

By HUGO GERNSBACK

IN our November, 1929, issue, we announced a 300.00 prize story contest. The requirements of this contest were that a short, SHORT science fiction story was to be written around the cover picture of that issue.

The story was required to be of the science fiction type, and was to be plausible in the light of our present scientific knowledge.

The contest came to a successful close on December 5th, when some eight-hundred-odd manuscripts had been received.

This, indeed, is a tremendous number of manuscripts for a contest of this kind and, if we go by the number of entries received, the contest must be declared a huge success.

Evidently, everyone wanted to try a hand at writing a short, *short* science fiction story. Of course, as is usually the case in contests of this kind, most of the manuscripts submitted were unquestionably by amateurs and would-be writers who had no experience in fiction writing. But we appreciate their efforts, even though we could not award them prizes.

It was a matter of great relief to the editors that few of the higher prizes were won by professional writers, and that they were carried off either by unknown writers or by those who are not professional authors.

This is exactly what the editors hoped for: because the contest was admittedly to encourage new authors. And, in this respect, the contest may be said to have succeeded beyond our fondest expectations.

It is hoped that all of our readers and the hundreds of contestants will realize the tremendous amount of work connected with a prize contest of this kind, where so many manuscripts must be assorted and graded and passed upon by the judges.

The judges also hope that their selection will meet the approval of authors and readers alike.

Mr. Charles R. Tanner, the winner of the first prize, undoubtedly submitted the best manuscript. It was, by the way, one of the few that had a surprise ending that was not only excellent in execution, but also correct from a scientific standpoint. No other author had noted the error in the coloring of the sky on the cover printed on the November, 1929, issue. The error was, of course, intentional; for in similar covers in the past we have always used the correct black sky, as, for instance, in our August, 1929, issue.

A number of the prize winning stories will be found in this issue. The remainder, including the "honorable mentions," which we have purchased from the authors, will be published in the April issue.

It is to be hoped that our new authors have been sufficiently encouraged by this prize contest to try their hands at longer stories, and so gain all the joy, distinction and material rewards that our writers receive.

Checks have been mailed to the prize winners, and the most memorable of our prize contests is hereby declared successfully closed.

Before the Asteroids

by KARL VINCENT

(Illustration by Paul)

These new devices began belching forth what appeared to be immense volumes of a gas of a faint blue color. The gas billowed upward and outward until it appeared to completely cover the scene.

FOREWORD

MORE than a half million earth years have passed since Olar, son of Nur, ruled supreme in the land of Keron. He was the last of a long line of despots; and, likewise, last of the rulers of the great empire that dominated the planet Voris.

In those days there were but two inhabited bodies in the solar system; the other being Arin, now known to us as Mars, and considerably younger in its civilization than was Voris, whose orbit lay between those of Mars and Jupiter. The two planets were quite similar in physical characteristics; though their seasons were somewhat different because of the greater inclination of the equator of Voris to its orbit, its faster rotation, and its longer period of revolution. But the peoples were so alike in appearance that they could scarcely be distinguished, were it not for the differences in their wearing apparel.

Our knowledge of the existence of the planet Voris, once about 248 millions of miles from the sun, and of the fate which eventually overtook that body, we owe to the untiring efforts of those two intrepid scientists, Moody and Bedworth. There was widespread skepticism when, in 1971, they announced the completion of a rocket-propelled vessel in which they intended to undertake a journey through space. Later, when the start was actually made, and the shining torpedo-shaped vessel went roaring into the heavens under the motive power of rapidly-recurring explosions from the seven steel tubes clustered about its tail, the two scientists were given up as lost. And, indeed, it seemed that the world was correct in its gloomy predictions; for more than three years passed without any news from the two adventurers. In the rush of events they and their experiment were well nigh forgotten.

Then, one night in July, 1974, there came the startling information from the International Voice-Vision news broadcasts that Moody and Bedworth had brought their space flier to a safe landing at a point not far from the city of Phoenix, Arizona. The incredulity of the listeners gave way to astonished belief as the first reports were confirmed by officials of that city; and the television screens of the news service soon flashed views of the great welcome being staged there for the explorers. The subsequent revelations made by the two men provided excited comment and speculation throughout the scientific world for many months.

The findings of the two scientists, fantastic as they seemed at first, were indisputable; and to astronomers they brought definite proof of several previously-disputed theories, and a vast amount of valuable knowledge of the heavens, made possible by extensive photographic records of observations made on and near the surface of Mars. There were likewise many stereoscopic motion pictures, which gave detailed information of conditions on that body. We learned that it had once been populated by a race of beings whose intelligence and scientific achievement far surpassed our own.

HARL VINCENT

Of prime interest to scientists was the proof of the origin of the planetoids or asteroids, long a matter of dispute. For a time there was considerable argument pro and con, certain astronomers refusing for many months to credit the evidence brought back by Moody and Bedworth. This was because this evidence re-established a long-discarded theory of the early nineteenth century, which had been framed when the discovery of the planetoids Pallas and Juno led astronomers to the belief that these bodies were but fragments of an original large planet which had in some manner disintegrated. This theory having later been abandoned, the scientists were loath to revise their opinions and revert to the earlier suppositions. But, eventually, the translations of Martian records of the distant past proved the case so strongly that it was necessary for the dissenters to join the growing ranks of those who accepted the conclusions of Moody and Bedworth.

Being modest and reticent men, the two scientists gave little expression to the hardships and dangers of their remarkable undertaking; so there is much that is still unknown regarding the adventures which must have been their lot during the three years they remained on the red planet. But much can be inferred from their writings; since these point to the necessity of much toil and the visiting of many widely-separated regions of Mars. Their reports regarding the temperature and climate likewise give an indication of the difficulties which must have been encountered during their stay. How they existed for so long on a body of such desolation can but be conjectured; though it is apparent from passages in several of their books that they lived mostly on the flesh of flying creatures—the only form of life on a world almost devoid of water. It is also presumed that their camp was near one of the polar caps where snow and ice was more or less abundant, and that their journeys to other regions were made in the tiny collap-

Of the unexplained mysteries of our solar system, none present more possibilities for the imagination than the origin and nature of the asteroids—those minute planets that lie between the orbits of Mars and Jupiter. Ranging in diameter from a few miles to a few hundred, these bodies seem to present an eternal question mark to the scientist endeavoring to discover how our system came into existence.

One of the most interesting enquiries into the question came from Bode, an eighteenth-century astronomer, who worked out mathematically an explanation of the distance from the sun of each planet. According to his calculations, there should have existed a planet between the orbits of Mars and Jupiter, at a distance of approximately 250 millions of miles from the sun; this belt in space is actually occupied by the asteroids.

Our well-known writer uses the scientific data of Bode to work out a very ingenious story as to how the asteroids came into existence. And, although the actual means that Mr. Vincent pictures are but one of the many possibilities, we feel sure that our readers will agree that, in the far distant past, before any semblance of human life appeared on our earth, a stirring interplanetary drama—a tremendous conflict to the death may have been waged between highly-civilized races.

sible airplane they had carried in the space-ship when they left the earth. But, though the labors of Moody and Bedworth have produced weighty volumes which are valuable to the scientific world, the language is technical and the conclusions coldly analytical, leaving the romantically-inclined reader untouched, if indeed he can be persuaded to read a single volume to its conclusion.

How they located the ruins of many Martian cities and excavated for relics and records of the prosperous past ages seemed to the explorers to be of little consequence to the world; for they laid stress only on the final results of their labors. What captures the popular imagination is the unearthing, on the site of La-dar, which was learned to have been the greatest of all Martian cities, of a huge case in which the most amazing series of records imaginable had been preserved for the edification of future generations. This case was constructed of non-corrosive metal and had been hermetically sealed; so that the contents had been retained perfectly in their original condition for more than five thousand centuries of earth time. These records comprised the most valuable discoveries of the scientists, and have inspired most of their writings.

To the lay mind it seems incredible that, at a time when no higher form of life than the ape-men of Java existed on earth, the discoveries of the Martians were far in advance of our highest present-day accomplishments. But the records themselves prove this to be the case beyond shadow of doubt; and the clever manner in which they were prepared for the use of any intelligent beings who found them is a thing at which to marvel. When Moody and Bedworth first opened the metal case they were nonplussed by the many complicated mechanisms it contained; and we know that more than a year was required merely to learn the uses of the various portions of the apparatus. There were hundreds of reels of fine wire of extreme toughness and brilliant polish, and it was discovered only after much painstaking labor that these reels were intended for use in bringing the machine to life as a medium of carrying the thoughts of the ancient Martians to any future race that might be interested in them. Those who have witnessed the operation of this thought apparatus will never cease to marvel at the experience; for it is one that defies duplication by any agency that we possess.

Each reel of wire is a book, and when it is run through the Martian machine its story is clearly conveyed to the mind of the observer in pictures and in speech. The process is telepathic and, when the proper connections are made to helmets worn by the witnesses, it seems as if they are actually living in the times portrayed. With eyes closed, the observer is cognizant of living pictures presented as clearly as on the television screen, and spoken words are conveyed to his brain as in his own language.

THE author was particularly fortunate in winning the confidence of Harley Bedworth and in examining many of the "books" of the ancient Martians. These experiences have been of the highest interest, and have given rise to a determination to bring to the world the story possessing the greatest romantic interest. This tale has been robbed of much of its human appeal in the telling by the matter-of-fact Moody and Bedworth.

Perhaps the messages of these ancient reels of wire are conveyed in different manners to different minds; which may account for the overemphasizing of technical details and the lack of romance in the works of Moody and Bedworth, as well as for the reversal of this order of things by the author. However, if the reader so desires, he may compare the present work with that of the scientists* and may thus assure himself of the accuracy of the descriptions and the historical events recorded in this story.

It is hoped that the narrative will prove interesting and instructive to those who have neither the time nor the patience to make a technical study of the vastly superior writings of the two men who actually explored the planet once known to its inhabitants as Arin.

Allow me to say in conclusion that one of the greatest difficulties experienced by the explorers in interpreting the Martian history was in unravelling the numbers and quantities referred to. From all the studies and evidence accumulated the Martian system of time was reckoned on their own year of 684 days. Their days were grouped in units or weeks of 12, there being 57 weeks. Each day was divided into 12 parts. Their day was approximately of the same duration as our own. Their numerical system also was based on units of twelve. So for convenience we will in this story call 12 of anything a unit.

CHAPTER I

The Prince of Marida

TORVEG XI, mighty monarch of all Marida, gazed thoughtfully from a window of his chambers in the great palace of La-dar. He was alone; and his meditations were on the glory of the past and of the possibilities in the future for his beloved country, the most powerful and prosperous in all Arin. There came to him a sense of gratification as he watched the rapid comings and goings of those of his people who rode the moving ways far beneath him. Raising his eyes to the heavens, he was further pleased by the sight of an unusual number of graceful aircraft which sped about in endless procession. His reign had been for Marida the happiest and richest since the great war with Voris during the rule of his ancestor, Torveg VII. And, with the completion of the latest extension of the main canals which provided his peoples with an increased supply of water, the future seemed indeed bright. When the time came, he thought, he would relinquish the throne of his forefathers with the comforting assurance that he had kept his trust well.

The occasion for this meditation was a momentous one; for on this day his only son Ronal, heir to the throne, reached his manhood.* And Torveg was at this moment awaiting the appearance of the handsome and active youth whose early life had given such great promise. A worthy son was Ronal—a man after his father's own heart.

In his own chambers the young prince was submitting to the final ministrations of a man-servant who took every effort on this important morning to see that his young master was looking his very best. For Barlo had attended the young man since nursery days and was inordinately fond of him. He had, besides, a measure of professional pride in the appearance of his master; and, when he had finished his work, Barlo stepped back to view the results.

"Your Highness is positively magnificent," he breathed ecstatically; "When the ladies of the court set eyes upon you, they will lose their hearts *en masse*."

Ronal laughed delightedly: "Barlo, you old sinner," he retorted, "it must be that you have a very great favor to ask. For you were ever a flatterer when about to request a day off."

"Oh no, your Highness," objected the valet, with an injured air: "You have but to survey yourself in the glass to observe that I speak truth."

And indeed, the young prince presented an appearance in his new habiliments that would delight the eyes of all. Fully twice as tall as a table** his body was as straight

* "*Origin of Worlds*"—*Moody and Bedworth* (*Yale University Press*, 1976).

* Majority.
** Over six feet.

and sinewy as that of any athlete in the dominion; the close-fitting uniform of deep red served to show to greatest advantage the perfection of his physique. The strength of his lean bronzed features was accentuated by the exceedingly high brow and close-cropped thatch of chestnut hair which surmounted a perfectly-shaped head. The corners of his mouth drew upward in an amused quirk as he observed the worshipful expression in the eyes of Barlo.

"Are you sure you have no special favor to ask?" he inquired with a grin.

"Well, your Highness," returned Barlo sheepishly, "now that you mention it, I should like your assurance that my services will be continued throughout your travels."

"Why, you old fox! I knew you wanted something. But, if that is the extent of your desire, you may rest easy. I could not do without you."

With that remark Ronal turned on his heel and went to meet his father, leaving Barlo in an ecstasy of pleasure over the pronouncement.

Torveg was aroused from his reverie by the click of heels close by, and he turned from the window to observe his son, standing at attention with his closed right fist pressed to his forehead in the royal salute.

"Salute me not, my son," said Torveg, "for from this day forth you are your own master. Today you assume your rightful place in the house of Torveg, and in the future you will receive the royal salute from our people, even as do I."

"It shall be as you say," responded Ronal, snapping his right hand smartly to his side and advancing to his father's chair, "but I fear that I still have much to learn regarding the responsibilities and prerogatives of my position. I trust you will bear with me during my novitiate."

"My son, I shall be pleased to tolerate much from you, should the necessity arise. But I am certain that there will be no such necessity. I am proud of you, my boy, and have great hopes for you. You have been a comfort and a joy to me since your dear mother left us; and I know that you will prove an even greater source of comfort and strength in my declining years. I shall miss you greatly while you are away."

"Must I leave at once?"

"It is the law, Ronal. For two years you must travel throughout the dominion, living in close contact with our people and sharing their joys and their sorrows, that you may be better prepared for the leadership that is to be yours. It is likewise decreed, as a preliminary, that you visit Voris incognito and learn what you can of the peoples of Keron."

Ronal's eyes shone eagerly. He had long looked forward with keen anticipation to that visit to distant Voris. "I understand fully, father," he replied, "and I shall endeavor to uphold the honor of our house in every sense. I, too, will miss the companionship which has been ours—your affection and counsel as well. But the separation is only in the flesh and is not for long. By means of the thought projectors we can remain in daily contact."

"Yes, that is true." Torveg's voice brightened at the thought! "And now, my son, run along to the garden. Andites awaits you."

So Ronal, after a word of cheer, left Torveg to his meditations and hastened to the garden for the appointment with his tutor.

Andites

IN his accustomed seat beneath the bower of purple *ydrac* sat Andites, and he greeted Ronal with unusual warmth when that exuberant youth came upon him.

"Ronal, dear lad," he said, somewhat sadly, when their greetings were over, "your education is completed."

The gray-haired philosopher and scientist who had tutored the young prince since his early childhood gazed long and earnestly into the clear gray eyes of his pupil. What he saw there was good, and he drew a contented sigh as he awaited the reply of the suddenly solemn youth.

"BUT, Andites," came Ronal's objection, "there is still very much to be learned. Surely we are not to be separated now."

"You have uttered words of wisdom beyond your years. Truly there is much to be learned. A lifetime is entirely too short a period in which to absorb all knowledge. But, from this time forth, your knowledge must be obtained by actual contact with life, with the activities and the customs of Arin. My instruction is finished. It is but the foundation of that greater knowledge that will accrue to you during the years to come. You and I are to separate, insofar as our intimate association of the past is concerned. But think you not that Andites is passing from your life. It is true that I shall no longer reside in the palace, but you must never forget that in my own humble home I shall be available at all times. In any crisis that may appear in your life, Andites is to be relied upon for advice and guidance. Come to me often, lad."

"Indeed I will." The boy's voice was serious. He felt a genuine affection for Andites, and was much perturbed over the realization that he was no longer to have him as a daily companion and mentor. "And will I not be able to keep in touch with you by means of the thought projector?" he inquired anxiously.

"Most assuredly. I will look forward to frequent calls from you, wherever you may be. But, before we take our farewells, there is one point regarding which I wish to caution you. This is a matter of grave import and I have never spoken of it before in your presence. When I have finished I wish you would lock my words in your memory for future reference, so that you may be guided in forming your own opinions and in preparing for the inevitable in the years to come."

Ronal gave close attention, for never had Andites spoken to him in this manner. "Of what is it that you wish to speak?" he inquired.

"Of the future of Arin and of Voris. Even though I shall touch upon the probability of another war between the two planets, there is a still more serious problem concerning which I shall not advise you until a full year has passed. There are many who think of Andites as an alarmist and who do not agree with his predictions of another interplanetarian war in the near future. But such a war will certainly come; and when you are traveling on the planet Voris you must make every effort to determine for yourself the approximate time of the intended invasion of our world and the means to be used in attacking us."

"Is this fact?" asked the astonished youth. "Why, it seems well nigh incredible. My father, I am sure, anticipates no such thing. And what possible reason should the Vorisians have for attacking Arin? We are a peaceable people."

"It *is* fact. But you must keep your own counsel until you are able to see for yourself. Full well do I know that your most respected sire does not see matters in this light; but I tell you, lad, that this war is coming, as surely as you were born. The reason is jealousy; and the war lords of Keron are but awaiting an excuse to descend upon us in force as they did in the days of old."

"Well—this is most astonishing," stammered Ronal: "Of what can the Vorisians be jealous?"

"Of our remarkable progress during the past four generations. Remember, my lad, that our civilization is but twelve thousand years old while that of the people of Voris has developed through nearly twenty thousand years. A hundred years or more ago we were far behind them in

learning and in accomplishment; but since the great war the position has been reversed. Arin has developed intellectually by leaps and bounds, while Voris has retrogressed. Theirs is becoming a debased and decadent civilization, though they have every advantage in natural resources. This is enough for now, dear Ronal. Keep these thoughts in mind when you are among the peoples of Voris. Examine well the possibilities there. Farewell, my boy."

"Farewell, my Andites." And the younger man's eyes grew misty as he touched his forehead to that of his tutor in the manner of the people of Arin. He turned quickly away and no further words were spoken by either; for it was not considered good form, among the Arinian upper classes, to display melancholy emotions.

Ronal returned to the palace a much sobered youth, and the words of Andites sank deep in his consciousness.

CHAPTER II

Ronal's Departure

THERE followed several days of feasting and celebration of Ronal's birthday in the palace and throughout the city of La-dar. But Ronal had not the interest in the proceedings that he had anticipated. He was too impatient to start on his journey to Voris; and the flattering attentions of the feminine members of the court bored him to exasperation. Barlo had been right in his predictions and, as Ronal humored one after another of the fair charmers, he became more and more convinced that women were sentimental fools. But then, he was a great student, and he had never found much time for the other sex. So it was hardly to be expected that he should change his inclinations in so short a time. Then, too, the parting words of Andites had so impressed him that he could think seriously of little else.

At last came the night of his departure. Ronal was as excited as Barlo, who fussed with the preparations in ill-concealed nervousness. It had been arranged that the young prince should travel as an ordinary engineering student, gathering the data required for post-graduate degrees. Torveg's councillor had signed a passport stating this. Ronal was attired in the customary garb of the character he had assumed, and Barlo retained his usual role of valet.

"All is in readiness, your Highness," panted Barlo as he closed the last baggage case.

"Here, this will never do," admonished Ronal. "You must remember I am no longer 'your Highness'—just plain 'Mattis'. That is the name on our passport, and you must be very careful to make no slips, or we shall find ourselves in difficulties."

"Very well—er—Mattis. But it seems entirely too familiar. I find it very difficult to address you in this manner but, never fear, I shall not forget."

Ronal laughed. "You should not feel embarrassed at the seeming familiarity, Barlo, after tending me so carefully these many years. But come, we must depart."

So, after taking hasty but affectionate leave of Torveg, Ronal hurried to the uppermost surface of the palace, where one of the speedy wingless aircraft of Marida awaited him. Barlo had preceded him and their baggage was already stowed away. The start was made immediately, and they were soon high above La-dar, speeding towards Mi-ran, whence they were to set forth on the journey through space.

The first leg of the trip was over none too quickly for the two adventurers. Beneath them was Mi-ran. The little ship they occupied dropped rapidly to a landing among many others of its kind in the extensive field beside the great humming power plant of the interplanetarian transportation system.

"I do not quite understand this new method of traversing space," said Barlo, gazing aloft at the huge steel building which housed the whirring machinery. "As I have heard, there are none of the old ships used now in making the voyage."

"You understand correctly," replied Ronal as they stepped from the cabin of their small craft and proceeded to the entrance of the vast structure: "The older method of traveling in torpedo-shaped vessels with rocket propulsion was entirely too slow for our modern requirements. We now make the trip to Voris by means of a beam or ray of complicated vibrations that travel to our destination at one hundredth the speed of light*.

"Our ships are actually hurled through space at such a terrific rate?" asked Barlo apprehensively.

"Yes. But you will not be conscious of it, nor is there any danger in the process. You see, these complicated vibrations actually establish a magnetic beam composed of a stream of electrons across space. On this powerful beam the ship travels."

"But suppose something should happen to the beam? Suppose, for instance, the beam should miss its mark?" Barlo was not exactly comfortable in mind.

Ronal shrugged his broad shoulders. "Nothing ever happens. The beam can not miss its mark, for there are powerful attracting forces at work on the other end which correct any errors in direction and assure the impingement of the ray of vibrations on the collector of the receiving apparatus. You need have no fear."

They had entered the large outer office and, after the passport had been scrutinized and approved, they were taken in charge by a guard and conveyed rapidly to the top level of the great building. By this time their ears had become accustomed to the roar of the machinery, and they were surprised to find that it now came to them as a not unmusical hum with a throbbing undertone that seemed somehow to steady the nerves.

They emerged on a balcony which overlooked the huge engine room, where not less than twelve great generators were in operation. These generators, the guard explained in reply to Ronal's interested inquiry, were delivering the quantity of operating power required. Truly, vast amounts of energy were needed in the remarkable process used in providing rapid transit facilities between Arin and Voris! The many generators were driven by individual motors of a type familiar to Ronal, compact atomic engines using as their fuel small quantities of ordinary rock, the disrupting atoms of which provided the tremendous driving energy with but little expenditure of the cheap and plentiful material.

After a thorough physical examination by a number of specialists, they were passed to the transmitting platform, which was an immense circular flooring that occupied the greater portion of the roof space on the building. The circular area was illuminated by flood lights and in the exact center there was an enormous bowl of glistening metal. This bowl was mounted on a turntable which incorporated double trunnion supports, and the open surface of the bowl tilted at an angle of about sixty degrees with the horizontal. At the side of the bowl was a large reflecting telescope with its latticed length of tube pointed in the direction faced by the open mouth of the polished bowl. On the bowl was a large spherical ship, its door already open and admitting the oncoming passengers.

"Here," said the guard, "you may see the planet to which you are traveling."

* 1,860 miles per second

The Journey

HE directed them to the eyepiece of the telescope, and Ronal thrilled at the view of the surface of Voris as it appeared in its brilliant splendor. The magnification was so great that the field of vision included only a small portion of the face presented toward Arin. He could distinguish clearly a rugged sea-coast and a series of mountain ranges, through which two broad rivers wound toward the ocean. Covered by the crossed hairs in the exact center was an irregular splotch which the guide told him was Kir, capital city of Keron. Barlo followed his master in viewing the image and he was giving vent to exclamations of amazement, when their ears were assailed by a terrifying sound which emanated from the bowl beside them! They turned startled eyes to the guide, who smiled and ran rapidly up the steps of a nearby platform, motioning for them to follow.

The passengers had all entered the sphere and it awaited only our two travelers before departing. Looking up, they could see an intense purple beam stretching through the night toward a faintly twinkling star that they knew was Voris.

Hastily entering the car they took the cushioned couches made ready for them.

The sound from the bowl rose in pitch until it reached a screaming note that well nigh shattered the ear drums. Then it vanished as it reached supersonic frequencies and the ensuing silence came as a distinct shock. Brighter glowed the bowl until its rose colored radiations bathed the sphere from top to bottom. The polished inner surface of the bowl reflected the light with dazzling brilliance.

Then there was a thump, a wrench as of the warping of the universe, and they felt themselves free in space.

"Comfortable?" came into Ronal's ears from the phone beside his couch.

"Quite," replied Ronal. He smiled at Barlo questioningly. But Barlo did not answer. He was terrified into speechlessness, and lay panting on his cot.

"You are extremely fortunate," came the voice of the unseen attendant, "for Arin and Voris are approaching conjunction at the present time. The distance is but 120,000,000 miles and the journey now requires less than a day."*

Ronal raised his head to gaze skyward and, when he made out the brilliant point of light that was Voris, he wondered what the succeeding half-year in that far-off world held for them. Somehow, he felt a foreboding of grave complications, but his heart beat faster in anticipation of the adventures to come.

Then came a sense of drowsiness. His head felt very heavy and he sank into a sweet dreamless sleep.

CHAPTER III
Voris

"A DAY—a hundred years!" Ronal found himself repeating the words over and over, under his breath. Then suddenly he realized that he was awake and that something obstructed his vision. He remembered! Rising from his couch he saw Barlo standing by him. Their luggage was being carried outside by a guard. Following with a feeling of great physical vigor that follows a refreshing sleep, Ronal found himself in brilliant sunshine instead of the glare of floodlights. They had arrived at the landing tower of Kir.

Surrounding them was a metallic ring a hundred feet** or more in diameter, from which was suspended a sort of a net of woven cords. In the center of the net was a small platform and it was on this platform that the travelers had arrived. Shouts came to them from below in the language of Keron. Ronal peered through the mesh of the net and saw that they were but a short distance above a large field where a number of the inhabitants were busy at the controls of a derrick-like machine.

"We are here, Barlo," he said, shaking the dazed man into wakefulness.

Still unbelieving, his companion looked dazedly about him. Then he brightened perceptibly. "Why, so we are," he said in a relieved voice: "I thought we were in the land of lost souls, but it seems I was wrong." He bustled about in a sudden accession of energy, loading their baggage into a cage which now dangled at the side of the platform.

They were soon swung out over the edge of the ring and lowered to the ground, where a surly official surveyed them suspiciously and made careful examination of the passport. But everything was in order, and they were passed through a gate into an open space where a number of public aerocabs were in waiting for arriving passengers. Of course, Ronal had learned thoroughly the languages of Keron and was thus able to make his wants known without difficulty. He selected a cab and ordered the pilot to convey them to the best hotel in Kir.

The air vehicle of Keron was but slightly different from those of Marida; obtaining its lifting force by means of a similar gravity-neutralizing field and being propelled by the discharge of expanding gases from a point beneath the tail. They rose quickly to a moderate altitude and headed for the city of Kir, the walls and towers of which could be discerned in the distance. The visitors experienced a slight sense of discomfort; for it was considerably warmer here than in their own land and the humidity was far higher. But otherwise they observed little difference from conditions on Arin, though the sun was shining less brightly here by reason of their greater distance from the luminary.

"Do you desire to encircle the city before landing at the hotel?" inquired the pilot, who seemed to be friendly enough.

"Yes, that is a good suggestion," agreed Ronal. "It will give us an opportunity to orient ourselves."

"You have never visited Voris?"

"Never. And we are looking forward to it with much pleasure."

"Well, you have arrived at a good time. In the city of Kir the celebration of Matara is now being observed—one of our holidays, you know—and there is much merry-making. We shall pass over the amphitheatre where Olar is now reviewing his mounted guard."

Ronal translated rapidly to Barlo, who displayed keen interest in the news. This entire trip was more or less of a holiday to the middle-aged man who had left the city of La-dar but three times during his entire lifetime. But the young prince was not so enthusiastic; for Andites had told him of some of the orgies of the Keronians when on holiday.

The air was filled with pleasure craft, and beneath them spread a city of a size fully as great as La-dar. Its upper moving ways were crowded with people in holiday attire. The high walls surrounding Kir were bedecked with emblems and banners of many colors, as were the myriad aircraft that darted and circled about them on every side. Now they shot past a tall spire, that rose from the upper surface of the city to so great a height that its pointed tip seemed to be but a few feet beneath them. The pilot advised Ronal that this was the spire which surmounted the palace of Olar, ruler of all Keron, and thus, by overlordship of the mightiest nation, the actual dictator of his entire world.

Now they were over the main thoroughfare of the city, a broad central lane of traffic on either side of which rose the larger buildings of Kir. These, unlike the pleasingly-

* This figure has been worked out as being probable
** Again an estimated figure.

decorated edifices of La-dar, were monotonously uniform in construction, and of neutral hued, non-corrosive metal. Were it not for the holiday decorations, thought Ronal, this city of Kir would indeed present a drab and uninteresting appearance to the eye of the cultured visitor from Arin. Ahead of them, the central roadway terminated in a large circular area which they soon made out as the amphitheatre of which the pilot had spoken. Then they were directly overhead; and the cab dropped still lower and hovered about to permit them to witness the scenes beneath.

In the exact center of the arena was a large dais, upon which sat Olar and his royal party in the midst of his courtiers and ministers. The stands were packed with his subjects, and the gesticulations and flag-waving of the multitude viewed from above produced the effect of a restless body of water. In a circular track, which occupied the entire space between the dais and the stands, paraded the royal guard, several hundred brightly plumed soldiers mounted on *yaraks*, those swift-footed striped quadrupeds whose breed had been perpetuated through the ages. The maneuvers of the perfectly-trained troops proved of interest for some little time and then, suddenly very tired, Ronal directed their pilot to convey them to the hotel. The effect of the sleeping gas given to them on the journey was beginning to wear off.

The little aerocab carried them quickly to their destination and soon dropped lightly to the flat roof of one of the larger structures on the main thoroughfare. Here they were welcomed by one of the uniformed employes of the huge hotel who took their luggage and guided them to an elevator which carried them to the floor where they had their rooms. After partaking of a satisfying repast, quite similar to one of their usual meals at home, they retired to the elegant suite to which they had been assigned and prepared to secure a more natural rest.

The Warning

RONAL did not know that he had slept through the remainder of the day and the entire night, when he was awakened by an insistant musical note which emanated from an instrument reposing on the small table at his bedside. The door leading to Barlo's room was closed; else that perfect servant would long since have replied to the summons of the thought projector which had roused his master.

Who could be calling him, in this land where he was entirely unknown? Who, excepting Barlo, knew his identity? Startled into complete wakefulness by these questions, Ronal sat up and touched the button which indicated his acceptance of the call. Then he stepped to the instrument and adjusted the cap that would carry the thought impulses from his unexpected communicant to his own consciousness. A small square of light appeared on the box of the apparatus, as the electrodes on the inner surface of the cap made contact with his temples. In this square of light appeared the face of a beautiful girl whose features betrayed anxious concern.

Quick as a flash came the thought waves that answered his own unspoken questions.

"It matters not who I am, or how I learned that the stranger known as Mattis, is not what he seems," came the thoughts of the charming young woman: "Suffice it to say that I am also a native of La-dar and am in favor at the court of Olar. It has come to my ears that one Mattis was placed under suspicion at the receiving station of the space traversing ray, and that danger awaits him. You must leave Voris at once."

Indeed he would not leave Voris! Why, he had just arrived, and had a half year of adventure before him! He would——

"Think not too deeply," interrupted the thoughts of the other, "or you will betray your true identity. And even I, who am your compatriot, have no desire to know who you really are or why you are here. But go—go at once from this place. Leave Kir—leave Voris entirely!"

With a fleeting smile from the imaged face, the square of light went dark and a sharp click from the mechanism indicated that the radiant energy from the unknown transmitter no longer actuated the instrument. Ronal raged and fumed, but there was nothing he could do. Not knowing who his fair informant was or where she might be found, he had no means of calling back or of learning more details concerning the strange warning. But he was determined that his stay in Kir was not to be shortened by so vague an admonition.

"Barlo!" he called impatiently, "Barlo!"

"What is it, your Highness?" replied the valet as he hastily thrust his head through the quickly-opened door.

"May the imps of the dry lands take you!" stormed Ronal: "Must I warn you anew that I am Mattis?"

"I am very sorry—Mattis," quavered Barlo, astonished at the unwonted display of ill humor on the part of his master: "I am still not fully awake and am therefore not alert to my responsibilities."

"It is my fault, Barlo," conceded the young prince, "but an anonymous call over the thought projector has put me in a rather beastly humor. A warning to leave Voris—what think you of that?"

"A warning?" Barlo's eyes opened wide in fear for the safety of his young master: "Some man of Kir knows that you are the son of—but I shall not repeat it. They know who you are?"

"No, but someone knows that I am not Mattis. And it is a woman, not a man."

"A woman? A woman of Kir?"

"No. This one, young and beautiful, claims she is from La-dar and the warning she sent is friendly. But she gave no details other than that it is officially suspected that Mattis is not as he seems to be, nor as his passport implies."

Barlo trembled and his kindly face went white. "We shall leave immediately?" he anxiously inquired.

"Indeed not!" barked Ronal, removing his sleeping garments and entering the room of the cold mist shower: "We shall remain. It is permitted by the treaty that a freeman of Arin may visit Voris twice during his lifetime. I shall not be frightened away."

He snorted and puffed in the cold water-mist that enveloped him, his usual good humor quickly restored. But Barlo's spirits sank and a sense of gloomy foreboding came over him. Silently he laid out his master's wearing apparel for the day and silently he returned to his own room.

CHAPTER IV

The Summons from Olar

IMMEDIATELY following the morning meal, Ronal inquired in the office of the hotel regarding the purchase of a private aerocab and was given the necessary instructions. With Barlo at his heels, he left the hotel at the seventh level and entered upon the moving ways of the main thoroughfare. They stepped quickly from the slow-moving outer way, across two of gradually increasing speed until they reached the fourth, and fastest, which carried them rapidly toward the shop to which they had been directed. Above and below them many levels of similar ways rushed noiselessly in both directions, carrying the populace of Kir about their daily affairs. It was quite like a scene in the lower levels of La-dar; but here the people with whom they rubbed elbows were dressed so light-

ly; in fact, Ronal thought, almost immodestly. Their faces bore the marks of riotous living. The words of Andites recurred to the young prince with ever increasing import.

They soon reached the establishment where the speedy aircraft of Keron might be obtained through the medium of exchange agreed upon in the ancient treaty with Arin. The purchase was quickly made, and a sleek, four-passenger cabin-craft was conveyed to the landing stage on the roof of the building.

"DO you require the services of a pilot?" inquired the salesman.

"No," replied Ronal, in the language of Keron, "I am considered an expert pilot in my own land. But I shall require a chart of the surface of Arin."

"That we can provide. But have you a license?"

"A license?" Here was an unexpected obstacle. "I was not aware that a license was necessary."

"It is a new law. We can not deliver the machine unless you have one."

"Does the obtaining of such a license involve much difficulty?" asked Ronal.

"None. Being a visitor from Arin, it will merely be necessary for you to present your passport at the license bureau and give evidence of your ability to handle the type of craft purchased."

So it was arranged that a pilot be supplied to carry them to the Aircraft Registration Department where the required papers would be obtained. But Barlo was nervously apprehensive of any procedure which involved further examination of their passport by officials of the government, and he did not hesitate to communicate his fears to Ronal while their vessel was being made ready for the start.

"Yes, that has occurred to me too," whispered Ronal, "but we must go through with it now and trust to good fortune that nothing develops. Probably all will be well."

But all was not well, for when they reached the proper officials and Ronal presented his passport, together with an application for a license, there was a considerable delay. Barlo's nervousness increased as time wore on and the official did not return with the credentials. But Ronal was already thinking of rushing to the landing stage on the roof and overpowering the hired pilot, if necessary, when the official returned with the passport and a metal tag.

"This," he announced, "is a temporary permit. There is some confusion regarding your passport and we had instructions this morning from the prime minister that a first class license was not to be issued to Mattis of La-dar. There was the further message that you are to report to the prime minister in the palace of Olar at your earliest opportunity. However, the permit will allow you to navigate your own craft over the city of Kir without molestation, so you will be able to go to the palace. It is my advice that you do this immediately; as the premier will be able to straighten out your papers in short order and you will then be able to proceed where you will."

Ronal's wrath rose apace at the official's suave words; but he wisely refrained from showing it. Accepting the permit and the return of his passport, he proceeded to the landing stage and dismissed the pilot who had brought them. He seated himself at the controls of the new craft and, when Barlo had closed the door, jerked the vessel skyward with a savage wrench of the gravitation lever.

"By the brain* of my ancestors!" he swore, "this outrage shall be avenged! It is incredible that a son of the house of Torveg should be refused the normal courtesies of this outlandish country. I must report to the premier! Indeed!"

"Was that the request of the official?" asked Barlo.

"Yes. In fact, it was practically an order. He said there is some irregularity in the passport and I am granted only a temporary permit." Ronal was raging, and they shot swiftly aloft through a bank of heavy clouds which hid the city from their view.

"Do you not intend to report—Mattis?" asked Barlo, glancing in all directions for signs of danger.

"I do not. We are going away from here—now. Hand me that chart of Voris."

But this rash resolve was never carried out, for, at that moment, there came the screech of a siren close by and a government vessel drew alongside. The etherphone of the new craft spoke loudly at Ronal's ear.

"Are you Mattis of La-dar?" came the inquiry from the larger ship.

"I am," replied Ronal in a surly voice.

"We have orders to bring you to the palace at once—orders from Olar himself. You are to be interviewed by his prime minister."

"Am I under arrest?"

"Not unless you make such a regrettable action necessary. And we do not believe you will do that. Few have dared to disobey when Olar commands."

Ronal peered through the transparent cabin walls at the speaker and saw that he was armed. He likewise observed that there were no less than eight other officers in the large ship, and that grim determination was written on the features of each.

He decided that he must capitulate.

"Very well," he grunted in the gutturals of the Kernonian tongue: "Lead on, and I shall follow."

IIa, The Beautiful

"THINGS begin to look discouraging, Barlo," Ronal commented, as the police ship of Keron dived into the clouds and he dropped his own vessel in its wake: "I can not understand the meaning of all this nor why it is that I should be under suspicion at all."

"What can they do?" asked Barlo.

"Legally—nothing. Of course there is the provision of the treaty that no members of the royal families of either planet may visit the other, but no penalties are attached. Besides, there is the precedent established when Nur, father of this Olar, visited Arin incognito and was discovered. Our people overlooked that incident; so there is no reason why my visit should raise such a tremendous furore in Kir if I am discovered. But still—I wonder."

"How could they have possibly known of your coming?"

"That is likewise a mystery. Still, they have evidently kept very close watch over us since our arrival, and it may be that there are spies in our own land. Perish the thought! And yet—!"

"You suspect something?" asked Barlo, realizing his master's indecision.

"I am beginning to. And I may as well tell you, Barlo, that Andites warned me of impending trouble between the two planets. It appears that he was correct in his assumptions."

"Andites told you of this? And still you came?"

"Most certainly. Think you that Ronal, son of Torveg, can be frightened by mere talk of wars and vague warnings of danger? But we have arrived, Barlo. We shall soon see what is in store for us."

They circled the spire of the palace, dropped to a landing beside the police ship, and stepped from their vessel. Without delay they were conducted to the elevator and soon emerged at the end of a long corridor. From the far

* This is not quite exact. Ronal probably refers to the telepathic organ of their race, located in the base of the skull.

end of the magnificently-carpeted hall there came the sounds of music and of revelry; but their guards stopped at a great bronze door only a few steps from the shaft of the lift. In another moment they had stepped into the presence of the Mara.

Underneath a high arch, that separated the room they had entered from a second larger chamber, sat the sinister Catin, Mara of Keron and trusted adviser of Olar. He glanced at Ronal and Barlo with bleared and shifty eyes that peered from beneath bristling brows in a furtive manner that was far from comforting. With a curt nod he dismissed the guards.

"You sent for Mattis of La-dar?" asked Ronal haughtily.

"I sent for him who carries the passport of Mattis," returned Catin with an unpleasant grimace: "Do you claim to be a student from Arin?"

"I do. And, if you will be so good as to examine my credentials, you will find them in order." With a disdainful gesture Ronal cast the scroll on the desk top.

As Catin examined the disputed document, Barlo fidgeted apprehensively, but Ronal gazed calmly beyond the bent head of the Mara into the larger chamber he had perceived. Then he received a shock; for between the heavy drapes at the far side of the inner room there appeared a vision of feminine loveliness such as he had never before encountered. Slender of body and fair of skin was the beautiful girl who faced him, and the dazzling smile she bestowed was a thing to remember forever. Her jet-black locks were encircled by a gold band and, just over the alabaster forehead, shone the jeweled emblem of the royal family of Keron. Silently she raised her arm and, with a graceful gesture, placed the tip of a finger to her lips. Then she stepped from the curtains and advanced to the side of Catin's desk.

Ronal's heart pounded unaccountably and Barlo peered quizzically at his master when he observed the sudden flush that mantled his features.

Catin, startled from his reading, looked up at the approach of the girl. And, when he had observed who she was, he jumped hastily to his feet.

"Your Highness!" he gasped, "I failed to hear you come in. Can I be of service to my princess?"

"THE princess!" thought Ronal, "No wonder they call her Ila the beautiful!"

Then an amazing thing occurred. The princess Ila drew her hand from the folds of her garment and they saw that it held a gleaming object, at sight of which Catin paled and cried out in fright. But, before he could raise the alarm, a beam of purplish light darted from the weapon to his breast and he slumped to the floor.

"You have killed him!" said Ronal in astonishment.

"No, but he will sleep for many days. An unkinder fate was reserved for you. We must hurry!"

She opened the massive door and peered cautiously into the corridor, then beckoned them to follow. Ronal stepped to her side and Barlo advanced timidly at her heels, his worst fears confirmed. The long hall was empty, but from the shadows at its end came the sounds of wild and discordant music. The revelers were uproarious.

"It is well," approved Ila, as she listened to the noise. "We will not be followed."

Then there came a terrified feminine scream from the shadows and the music was abruptly stilled. Ila grasped the arm of Ronal for support, uttering a single word in a panic-stricken voice:

"Mother!"

Sobbing with fright, she loosed her hold of Ronal's sleeve and raced madly along the corridor in the direction from which the scream had come. The two visitors from Arin, forgetting their own danger, followed closely behind.

CHAPTER V

Olar's Crime

THE scene in the huge chamber at the end of the hall was one not easily forgotten. Fully two hundred scantily-attired Keronians were scattered about in various stages of the wild intoxication produced by the drug *ceesal*.* On a raised platform in a corner of the great room was the throne of Olar and before it stood that mighty monarch, swaying drunkenly to and fro as he attempted to raise a feminine figure that lay before him. Ila ran across the room, stumbling over many a prostrate form as she made her way to the throne. With a violent thrust she toppled her almost helpless father into his heavily-cushioned seat. Then she knelt at the side of the prostrate woman and gently turned the face upward. She laid her cheek against that of her mother for a moment, and then sprang erect, her eyes flashing fire.

"Dead!" she shouted, advancing to the huddled figure of Olar. "You have murdered my mother, you beast! You and your vile court with your drunken revels! You are no father of mine, Olar the Great, and Ila warns you here and now to beware of your crown!"

With the palm of her tiny hand she struck the bloated face of the monarch. Then she knelt once more beside the still figure and burst into uncontrolled weeping. Unsteadily Olar rose to his feet, and as he did so a murmur of incredulity swept through the assemblage, for in his hand he still held the weapon with which he had brutally taken the life of his consort. The murmur swelled to a roar as he advanced on Ila, and Ronal shouted aloud as he sprang from the shadows where he and Barlo had remained. But quick as he was, there were others ahead of him, and before he reached the side of Ila, a dozen of the younger nobles had rushed to her defense. Olar was down and was being held in a subjection such as he had never experienced in all his tyrannical career. Those brave nobles of Keron, for all their recent debauchery, drew a shout of admiration from Ronal, for well he knew that their lives were forfeit, and that they had willingly faced death to protect their beloved princess from the drunken violence of her royal father.

In the ensuing confusion Ronal and Barlo were unnoticed, and it was not long before Ila, pale and exhausted, extricated herself from the milling combatants and joined them.

"We must leave at once!" she panted, "The guards are even now on the way and wholesale slaughter will follow their appearance on the scene. Ila's life is now in as much danger as your own. Come!"

Even as she spoke there came a detachment of the guard and every exit was jammed with frantic Keronians attempting to escape. Ila pressed a slab in a panel of the nearby wall and a black opening gaped before them. She thrust the two men inside and almost fell over them as she followed and hastily closed the panel behind them, just as the hubbub in the room they had quitted reached the proportions of a panic.

"Mother, mother, poor mother!" she sobbed. "At last you have found peace."

Then the girl calmed herself and once more took charge of Ronal and Barlo. She led them step by step through the dark passage until they reached a winding stair. Up this they climbed endlessly, still in impenetrable darkness. None of them spoke until eventually, with a hiss of warning, Ila stopped and they could hear her fumbling with the fastenings of a door overhead. A slit of day-

* A Keronian plant that acted upon the brain in a similar fashion to alcohol.

light appeared, and this widened to a considerable opening as Ila raised the trapdoor sufficiently for them to obtain a view of the outside.

"It is all right," she whispered. "Come!"

They followed her through the opening, and found themselves on the palace roof, close by the landing stage where stood Ronal's vessel. The stage was empty of Keronians; but the police ship still rested in the position in which it had landed. They hastened to the little cabin aerocar at Ila's direction and, when Ronal had opened the door, were surprised to see that another beautiful young woman had preceded them—the girl of the thought-projector warning!

"Mirsa, Mirsa," exclaimed the princess, throwing herself into the arms of the other girl, "I am so glad you escaped! Did you see?"

"I saw, my poor Ila, and left immediately by the central lift. I foresaw the consequences and hurried to the rendezvous. But we must be off, before the news is broadcast."

"Yes, yes," agreed Ila, "at once." She turned to Ronal. "And you, Prince Ronal, must remove the weapons from the police ship. We shall need them."

Aghast at the knowledge that he was known, Ronal nevertheless hastened to obtain the weapons in the police car. With Barlo's assistance he quickly stripped the vessel of its armament, which included the hand-weapons that projected the deadly disintegrating ray and two heavier projectors that were capable of destroying a vessel of like size. These were conveyed to his own craft and, when they were all seated within and prepared for the start, it was found that the quarters were crowded to the limit. Ronal, with his fingers on the controls, looked inquiringly at Ila.

"Rise immediately to the highest safe altitude," she directed, "and then I will instruct you further."

She had procured the chart and was examining it carefully. The little craft responded quickly to Ronal's touch and soon rose high above the clouds which still covered the sky.

The Escape from Voris

MANY things were explained during the rapid flight from Kir. Ila, though deeply grieved, succeeded in hiding her feelings, and she lost no time in making clear to the visitors from Arin the exact state of affairs. She had mapped out their course for Ronal, and the little vessel was now carrying them over the black ocean which separated Keron from Alata, whither they were bound.

"It is a long story, my prince," she responded to Ronal's inquiries, "but I shall endeavor to make all things known to you. First, I must reiterate my statement that Olar is no father to me. I have long since renounced him for the misery and suffering he has brought to my dear mother during the past years. Now she is gone—the victim of his brutality—and I have another score to settle with him. Few there are in Keron, in fact in all Voris, few who are fit to live; and I hope and pray that in the coming war with Arin the entire breed is destroyed."

"A war is coming?" asked Ronal.

"It has been planned for many years. Spies are everywhere in the land of Marida and throughout all Arin. It was through the agency of these spies that Olar learned of your coming to Voris; and it was through Mirsa's influence with Olar that we discovered the fact that you had arrived. When Mirsa ended her thought-projector contact with you so abruptly this morning, she did so in fear that her thoughts would betray the certain knowledge of your identity and that you would then not report to the palace when ordered to do so.

"Keron has been retrogressing morally for many, many years and things have now become so bad that no woman —not even the daughter of Olar—is safe. And it is a sad commentary on the decadence of our race when I admit freely that few of the women are better than the men. When Mirsa came from Arin I found a friend I could trust, and she has been my constant companion since. Olar became enamored of her, and life has been more difficult since then. But his infatuation enabled her to learn many of the plans for war against Arin and also of your coming. We had planned for her to escape these intolerable conditions and return to Arin with you. But now it has become necessary for even Ila to leave her native world."

"FOR which I am very thankful," quoth Ronal, forgetting for a moment the sad cause of her exile.

Ila looked deep into the eyes of this prince from distant Arin, and what she saw caused her to blush. She continued hastily:

"Arrangements had been completed for the stealing of one of the space ships from the great shipyards of Alata, and this ship is now awaiting our arrival. Its crew consists of but three Keronians in whom I have absolute confidence. One is Lyris, my personal maid since childhood. The other two are her husband and son, both Keronians of the strictest integrity—a rare virtue here, even among the servant classes. We shall be absolutely secure in their company, once we have escaped the atmosphere of Voris."

"You think we shall be attacked before we leave?"

"I hope not. But the alarm must have gone out by now, and I fear that Olar may suspect our destination and endeavor to head us off. In that case we must fight."

The coast line of Alata now came in view and Ronal changed his course slightly as they swung inland to follow the direction plotted by Ila. Beneath them they made out the heavy foliage of the wildernesses. Here and there, a city thrust its towers skyward through the thickness of the jungle. But they kept to an altitude far above the regular traffic lanes, and sped onward to the single hope of escape from the vengeance of Olar.

Soon they were in sight of the great shipyard where lay some twenty of the spherical space vessels which Ila had said were being groomed for the war against Arin. The etherphone was tuned to the frequency agreed upon with Ila's allies. A call was made and repeated, but no reply was received; and just then Barlo shouted out from his seat in the rear of the little vessel.

"A police ship!" he called, "Just above us, your Highness!"

Ronal dropped the ship in a nose dive and came up rapidly, intending to rise above the larger and more unwieldly ship which had followed them. As he did so one of the disintegrating rays from the police ship grazed the nose of the vessel and opened in it a great jagged gap. Ila frantically repeated her calls over the etherphone as the tiny car climbed swiftly to meet the enemy. Mirsa helped Barlo to set up one of the larger ray projectors, and they soon succeeded in training it on the under surface of the police ship. There was a puff of bluish smoke from overhead and their pursuers were no more. But still there was no response from the etherphone, and as they now descended the shapes of two more police vessels appeared rapidly nearing them.

They were directly over the shipyard and could plainly see the shapes of the great spheres that clustered within its confines. A voice rang through their cabin.

"We are coming, your Highness!" came the reassuring words, "We will pick you up aloft. Have your pilot land on our upper surface."

Then one of the shining globes left its fellows and came

up quickly beneath them. But the two police ships were now searching the air around the tiny car with their deadly rays and Ronal resorted to every maneuver with which he was familiar to keep them from finding their mark. Barlo did his best to direct the ray from his own weapon but the darting of the smaller craft made it quite impossible to reach one of the police ships. Another contact with the hull of their own vessel, and its tail disappeared in a puff of bluish smoke. But the space flier was just beneath and, as Ronal dropped in a rather heavy landing, Ila called out in triumph. Her friends on the upper platform of the huge sphere had just trained on their pursuers rays from two long-range projectors. Two smoke puffs were all that remained of the police! The fugitives were hustled inside the spherical vessel, and the circular manhole was clamped shut behind them. A quick lurch told of the suddenly increased speed and they knew that the sphere was shooting skyward with tremendous velocity.

They were bound for Arin.

CHAPTER VI

The Return of Ronal

WITH a five-day journey before them, the occupants of the space flier proceeded to make friends immediately. Barlo found much in common with Sulor, the husband of Lyris. Mirsa, even after the ice was broken, stood in great awe of Ronal and addressed him always as "Highness." But Ila conversed with him on terms of equality; and he soon discovered that she was a girl of unusual intelligence, and possessed of an education as extensive as his own. But for the first three days of the journey she confined herself to her rooms, with Lyris in constant attendance. Coming as a reaction after the excitement of the escape, the full realization of the passing of her mother struck her with overwhelming force and in her grief she chose to withdraw from the rest of the party. During this period Ronal spent a great deal of his time with Andon, son of Sulor, in the control room of the vessel, and he learned much regarding the recent activities of Olar.

Andon, it developed, had been employed in the shipyards of Alata for many years and was expert in the construction and operation of the spherical space fliers. These were modern developments of the older craft and resembled in many ways the ships used on the transportation beam. There were one hundred of the ships already built; and these had been distributed among five bases in isolated sections similar to the one in Alata.

When Lyris had advised him of the princess Ila's determination to get Mirsa back to her own land, Andon obtained a position for his father in the shipyard and immediately laid plans for the appropriation of one of the spheres with which to make the trip. They knew that Olar would never permit Mirsa to leave by the transportation beam; since his passion for her was growing in intensity until it had reached the proportions of an obsession. Later, Lyris had joined her husband and son for a visit, and she was overjoyed when she learned that her beloved princess also was to leave Voris; though she deeply lamented the passing of Ania, the queen.

"But Andon," Ronal had objected, when they were still but a short distance from Voris, "how is it that none of the other space fliers have attempted to follow us? I should think that Olar would have the entire fleet out searching for us."

"The others are not prepared for flight—because one of the vessels was badly damaged a short time ago in a trip taken by some employees of the shipyard when they were under the influence of *cesal*. It was then decreed that all vessels be rendered useless by the removal of the exciters of the atomic motors."

"How then were you able to provide this ship with an exciter?"

Andon smiled. "The exciter is really quite simple; and father and I were able to construct one from odds and ends we found in the machine shop of this particular ship. We have kept this a secret, so nobody expected to see the *CXF* rise when it did. We left a rather surprised commander behind us."

"It would seem, however, that one or more of the other spheres could be quickly prepared for the chase," said Ronal.

"Nearly half a day would be required, and there would then be no chance of overtaking the *CXF*, for all of these ships have the same maximum speed. We have no fear of pursuit, your Highness."

"The *CXF* is a duplicate of all other ships of the fleet?"

"It is. All have been built to the same specifications and drawings. The method of propulsion is the same as that used in the older vessels. Power is obtained by the atomic disintegration of ordinary shale in the motors. The gravity field is, produced electrically and may be varied in intensity and direction, or reversed to utilize the gravitation of various bodies in the solar system when we require such changes to alter our course or speed. There are accommodations for two hundred fighting men aboard each vessel, in addition to the normal crew of six."

"Of what does the armament consist?"

"There are, of course, the hand weapons for the fighters, ordinary ray pistols capable of annihilating the human body at a distance of two hundred yards. Then there are two great beam generators on each ship, either of which could destroy the palace of Olar or of Torveg from a distance of more than a mile. In addition, there are various other beams, and some gas bombs with which I am not familiar. Some of these weapons are of comparatively recent development and their exact potentialities have been kept secret from the pilots and engineers. But, from small talk I have overheard, it is certain that they are of a terrifically destructive nature."

"It is evident that Olar intended to declare war in the very near future, Andon." Ronal paced the floor of the control room in deep thought.

"He has been waiting only for some excuse, such as your arrival in Voris. I have no doubt now that the fleet will visit Arin almost immediately—and without warning. Are your people prepared?"

"We are absolutely unprepared," replied Ronal solemnly: "We of Arin have had no suspicion of the plotting of Olar. It was but a few days ago that I had the first hint of such a thing from my old tutor Andites, a noted physicist of La-dar. How he came to know of it is still a mystery to me."

"I greatly fear that Arin will prove an easy field for conquest, your Highness."

"It would seem so, Andon." And Ronal became lost in meditation pondering the problem presented to the peace-loving peoples of Arin.

A New Subject

EACH day these conversations in the control room brought new information to Ronal, and each day he grew more apprehensive of the result of Olar's plans and more impatient for the arrival in Arin. When they were still more than 60 million miles distant from his own world he attempted to get in touch with Andites by means of the thought projector of the *CXF*, though he knew

that they were entirely out of range of its low-power transmitter.

When, on the fourth day, Ila rejoined the party, it seemed that she had failed greatly in health; for she was hollow-eyed from loss of sleep, and her skin had taken on an alarming pallor. Lyris fussed about her continually, and Ronal's heart went out to the suffering of the unhappy girl.

"You have heard the worst?" she asked Ronal, as they conversed after their first meal together.

"I believe so. Andon has told me of the fleet and of what he knows of the plans of Olar. It seems that Arin is to become the scene of a terrible war."

"It will come very soon, I fear. But, from this time forth, Ila is no longer a princess of Keron. Her sympathies are entirely with the people of Arin."

"BUT there will be great danger for you in La-dar." Ila shrugged her pretty shoulders: "No more than in Kir, my prince. In fact I shall quite probably be safer with your people than with my own."

Ronal thought of the scene in the palace of Olar and shuddered. "Yes, that is probably true," he agreed. "And Mirsa? What will become of her?"

"She has her people. Her father is a Bodin* in La-dar, and is in very comfortable circumstances. I am expecting to make my home with her, at least for a time."

"I had hoped you would consent to take up your abode in the palace of Torveg."

"No, dear prince, that would never do. When the people of Arin learn of Olar's enmity they will hardly consent to the harboring of his daughter in the palace of Marida's ruler."

"But you are not an enemy," objected Ronal.

"I am a friend. And I hope to become more. I hope to become one of your people and to be happy among them —after the war is over."

"And I—I hope you will become even more than that." Again Ronal gazed deep into her eyes, and again Ila flushed, the spreading color covering the pallor from her beautiful features.

To hide his own embarrassment at the temerity of his words, Ronal stepped to the thought projector and made another call for Andites. He was delighted at obtaining contact almost immediately, and lost no time in transferring all of his thoughts regarding the events of the past few days to the eagerly receptive mind of his old tutor.

"This confirms my own suspicions fully," came the unspoken thoughts of Andites, "and I shall take immediate action. I shall apprise Torveg at once and request him to call together the scientists of La-dar to devise means of defense. You arrive tomorrow?"

"Yes, and I shall proceed to the palace as soon as we land. You think we might be able to make a fair show of defense?"

"It is not particularly hopeful, at least for the first attack. But I am not so sure they will be entirely successful. I have ideas—but those can wait. Immediate action is imperative. Farewell, lad."

"Farewell, my Andites." And, somehow, Ronal was greatly encouraged by this contact. He turned to impart the news to Ila, but she had taken the opportunity to escape from the room.

Then followed the longest hours of waiting that Ronal had ever known. He found that he was unable to sleep and, as a consequence, spent most of the rest period in the control room where Sulor was relieving Andon. Here, in the emptiness of space, there was neither day nor night. Or more accurately, one side of their spherical ship was always in daylight and the other side always in darkness. But regular sleeping and waking hours had been observed throughout the voyage, the time being based on a standard Vorisian chronometer. With its rays unobstructed by an atmosphere, the sun appeared as a vast ball of blinding magnificence, with brilliant streamers of flame extending in all directions far into space. Even at that enormous distance from the radiant center of the solar system, it was impossible to observe it with unprotected eyes. And, as soon as the eyes turned from the luminous body the blackness of the firmament seemed even more ebon by comparison; the stars and planets shining steadily and brightly like jewels set in a background of black velvet.

Then, when the others awakened, they gathered in the control room to join those who had spent so many hours within its confines. The orb of Arin was now large in the heavens, rushing madly to meet them. The north polar cap shone white in the glare of the sun and the great canals radiating from this point to irrigate the inhabited areas of the planet stood out blackly against the arid whiteness of the dry lands, monuments to the ingenuity and diligence of generations of Arinians.

Breakfast was forgotten in their absorption in the magnificent sight of the body as it drew so rapidly near them. The *CXF* seemed to hang motionless in space, as the great globe came so close that it filled their entire field of vision. Then, as they watched, there was no longer a globe but a vast bowl with the horizon as its rim. They had entered the atmospheric envelope of Arin and the speed of the ship was greatly reduced. Soon they were within a few thousand feet* of the surface, over the dry lands at a point not many ——** from Mi-ran, whence Ronal and Barlo had started their journey.

Ronal obtained thought-projector contact with Torveg and received enthusiastic and affectionate greeting. But in the rejoicing of his father there was an undertone of sadness and misgiving.

Soon they were very close to Mi-ran and Ronal pointed out to Ila the great power plant of the transportation beam, its bowl-shaped reflector gleaming in the sun and the ring of the receiving net clearly outlined against the green of the adjoining field. Even as they watched, there was an appalling concussion and the entire plant vanished in a cloud of smoke and hurtling particles that reached nearly to the *CXF*; which was rocked so violently by the blasts that they were compelled to hold to the control panels and ceiling supports to keep from being hurled to the floor. They stared aghast as the debris from the terrific explosion settled, and the smoke cleared away to reveal an enormous crater where the plant and the city had stood.

It was Olar's first blow. A car of powerful explosives transported over the beam had detonated on arrival, forever cutting off this means of communication, and causing great damage and loss of life. In awed silence the little party remained, while the *CXF* sped toward La-dar.

CHAPTER VII

War Clouds Hover

WHEN the *CXF* was brought to a landing beside the great canal just outside the city limits of La-dar, a large crowd had collected to witness the arrival of the travelers from distant Voris. Two aerocabs drew alongside the great sphere when the outer door of its air-locked entrance was opened, and from the larger of these stepped Torveg himself. The other cab had come for Mirsa and her friends, and was occupied by her father and

* A local commissioner of the government

* Estimated

** Probably a longer unit of measure such as our mile

brother, who welcomed her as affectionately as did Torveg his son. Ronal made haste to present the princess Ila and the rest of his companions to his father, who straightway offered the hospitality of the palace to all of the Vorisians. He was charmed with Ila, and made a special effort to induce her to make her home in the palace. But she steadfastly refused, though gently, and it was finally arranged that she and Lyris should accompany Mirsa, while Sulor and Andon were to accept the invitation of Torveg and take up their residence in the palace. Barlo drew a breath of satisfaction as he set foot on the soil of his native land; for there had been times when he was certain that he would never see Arin again.

Andites was first to greet Ronal at the palace, and to assure him that vigorous preparations were under way for the defense of La-dar. The city was a turmoil of activity, and the great manufacturing establishments of the entire planet had already been drafted for the turning out of war materials. The scientists of Arin were hard at work on the problems of devising adequate defensive armament and weapons.

"Our great observatories," said Andites, "are constantly on the watch for signs of the approach of the Vorisian vessels. But they have thus far been unable to discover indications that any have yet left Voris. Unfortunately, our telescopes are not of sufficient power to observe objects so small on the surface of the planet itself."

"What measures are being taken to provide defense?"

"There are the long-discarded disintegrating-ray weapons of the police and these are being repaired and charged for use. In addition, a number of large factories are starting work on the production of many more such weapons. This will require some time, of course; and in the interim we are providing for a protective barrier over the roof tops of our great cities."

"A protective barrier? How can this be arranged?"

"By projecting fan-shaped rays of high-frequency vibrations to form above the city a ceiling of pulsations, of such a frequency that the disintegrating rays of the enemy will be neutralized and dissipated before they can reach the surface."

"Can this work be completed in time?"

"That is the great difficulty. Work is being rushed; but it is quite likely that some sections will remain unprotected when the enemy fleet attacks. However, we are doing the best we can under the circumstances, and the invaders will not find Arin entirely defenseless."

"THAT is some consolation, Andites. But what think you of the final outcome?"

The older man gazed solemnly at the young prince. "We can but hope for the best and do everything within our power to fight off the invader. And I fear it is to be a great task," he stated.

"Yes," agreed Ronal gloomily, "and many of our people will lose their lives and much property will be destroyed."

"It makes but little difference," replied Andites, "for the days of our existence are already numbered, regardless of the impending conflict."

"Why, what do you mean?"

"I had not intended to tell you until a year had passed; but this development has altered all our plans, and I may as well inform you now. Ronal, all life on our planet—as well as that on the planet Voris—is doomed to extinction by natural agencies."

"By natural agencies? Surely you do not anticipate a disaster to the solar system—to the universe?"

"Yes—to the solar system. It is inevitable. Already the evidence of approaching calamity may be observed on the planet Borus,* where animal life has developed to no more than a very elementary stage, and where thinking beings do not yet exist. And the same influences now at work on that planet will shortly make their effects known with us. In fact, the changing seasons of our past few centuries give ample warning of the catastrophe to come; though most of our scientists refuse to recognize the symptoms."

Ronal forgot the menace of Olar for the moment in his astonishment. "What sort of a cataclysm is this to be?" he asked.

"All life on Arin and Voris is to perish by freezing. In your studies you have learned of the glacial epochs in the remote past of Arin and Voris. You are aware of the fact that these periods were encountered almost simultaneously by the two bodies and that warm-blooded animal life became extinct at those times. It is likewise known to you that the climate of Arin is far more rigorous than that of Voris; and some of the reasons for this are apparent to you through your study of astronomy. We have studied the atmospheres of the two bodies, and know their compositions to a nicety; but we have never before discussed the possibilities I am now about to touch upon. The carbon dioxide* content of the atmospheres is the vital factor in what, I believe, is soon to take place."

"Carbon dioxide? But Andites, that is so small a proportion of the atmosphere that, surely, it can not be of such great importance as you imply."

Impending Disaster

"IT is of tremendous importance. As you know, if it is present in excessive amounts, our lungs become poisoned, and eventually we die. But aside from that, its variations have a pronounced effect on the climate. The atmosphere itself is a blanket which surrounds a planet and prevents excessive heating of its surface by day and extreme cold by night. But the *composition* of the atmosphere is what determines its efficiency as an insulating blanket. You are well aware of the fact that frosts occur only when the air is clear and of low humidity. That is the reason for the low temperature of Arin as compared to Voris; for our atmosphere contains much less of moisture than does theirs. Water vapor is less susceptible to the long-wavelength heat radiations from the planet than are nitrogen and oxygen,* while there is not so much difference in the absorption of the shorter radiations from the sun.

"But carbon dioxide has the same absorbing effect as water vapor and, even though it makes up a small portion of the atmosphere, it has important climatic effects. In other words, a large amount of carbon dioxide in the atmosphere makes for a warm climate; while a deficiency in this constituent causes lower average temperatures. And the point of all this is that, eventually, the atmospheres of Arin and Voris, as of all other planets in the solar system, are to be deprived of their carbon dioxide, and the temperatures will be so greatly reduced as to make life as we know it impossible."

"But Andites, I still do not understand. What is there to rob the planets of their normal amount of carbon dioxide?"

"Again I say, natural causes. I have made an exhaustive study of the matter and have determined that the glacial periods of ancient times were caused by the passing of the entire solar system through a vast gaseous nebula whose composition is such that all carbon dioxide is absorbed from the atmospheres of those bodies where such an envelope is present. And calculations show that the solar system is again to pass through this nebula within a very few hundred years. Of course, you know

* The earth.

* The names of these gases are deduced from the context

that the solar system as a whole is traveling through space, in a vast orbit. Therefore, there must be definite cycles, during which the same points are passed through again and again. The time is near; and Arin will become frigid, and its canals will freeze solid. Voris will suffer even more severely; for there is much water on that planet and great glaciers will cover its face, crushing all in their path and snuffing out all life immediately."

"If this is true, how futile are our lives, our loves, and our wars! But how soon do you expect this calamity to overtake us? Within the lifetime of the present generation?"

"Perhaps so, my Ronal. It may be five hundred years and it may be several thousand, but surely not longer than that. So, you see, we have not long to remain here, regardless of the success or failure of the armies of Olar."

Ronal considered deeply. "Nevertheless," he said, at last, "I, for one, am not going to worry about this thing at present. Our successors have much time remaining in which to fret about this calamity, but for us there is an immediate danger that must be overcome. And it seems to me that something in your scientific reasoning might be used to our advantage in the coming war."

Andites was taken aback. "Why, what do you mean?" he asked.

"Just this: If carbon dioxide is so important to the life of a planet, why can we not contrive some means of depleting the atmosphere of Voris—now?"

"Why—why—it is an impossible undertaking! Still I am not sure but that you have put a feasible idea in my mind, at that. Let me see now. . . ."

And Andites became lost in thought; Ronal had indeed made a valuable suggestion. To take advantage of natural forces! . . . .

Then there came a great clamor from the council room of the palace, and Ronal promptly forgot his conversation with Andites as he hastened to learn the cause of the commotion.

"What is it?" he asked, when he had pushed his way through the assemblage of excited nobles and reached the side of Torveg.

"My son," replied the monarch of Marida, "it has been reported that the Vorisian fleet is within 1,500,000 miles of Arin. They will be upon us in less than one unit.*

Ronal paled. He thought of Ila, in a remote section of the city where defenses had not yet been established. "What are the plans of the council?" he shouted, endeavoring to make himself heard through the clamor.

"They demand that you be appointed commander-in-chief of the defense forces of Marida, and that a desperate effort be made to fight off the invaders. It is presumed that they will first strike at La-dar, for this is the seat of our government."

RONAL'S eyes sparkled in eagerness. "Nothing could be more pleasing to me," he exulted. "Where are the engineers in charge of the installation of the protective-ceiling apparatus?"

A cheer came from the assembled council when it was announced that Ronal was assuming command of the defense; and order was soon restored. The engineers were summoned to a private room, where drawings of the fan-ray generators and maps showing the locations of the completed installations were laid before the young prince.

It was apparent that La-dar was but half protected, for the ceiling-ray generators so far constructed covered only the central portion of the city. The outer residential sections were as yet open to attack, but work was being rushed in those districts as rapidly as possible. Again, with a sinking heart, Ronal thought of Ila where she dwelt with Mirsa's people in unprotected territory.

Haste was imperative and Ronal quickly chose the members of his staff and arranged for the installation of portable etherphones, television instruments and thought projectors on the roof of the palace, where he intended to make his temporary headquarters. By the time these arrangements were completed there came the report that the enemy fleet was over La-dar, fully fifty of the spherical vessels having been sighted at an altitude of 20,000 feet.* Darkness had set in; and the faint luminosity overhead told of the operation of the apparatus of the protective ceiling.

The first battle of the war was about to begin.

CHAPTER VIII

War!

RONAL'S first command was that all inhabitants of unprotected areas should proceed to those portions of the city where the ceiling of high-frequency vibrations was in operation. He despatched a special corps to the home of Mirsa to make certain that Princess Ila and all members of the household were conveyed to safety. Then he turned his attention to the details of organization. He called for Andites, but that worthy was nowhere to be found. He sent for Andon and Sulor, and kept them at hand to advise him regarding the armament of the Vorisian fleet. He set a corps of etherphone operators at work obtaining communication with all countries of Arin and checking up on the defense preparations in all quarters.

Ray projectors of large size were set up in the unprotected areas as rapidly as possible, and these were manned by volunteers, most of whom came from the ranks of the young engineers and engineering students. Then came the first attack on La-dar.

Through the hazy glow of the ceiling of vibrations, they could make out the lights of the Vorisian vessels; then came the orange streaks that carried the disintegrating energy from the generators aboard the great spheres. But these rays never reached the city, though the effects of their striking the protective ceiling was tremendous. Night became day from the vivid display of pyrotechnics above them, as the energy of the rays was expended in the atmosphere above the neutralizing vibrations. Electrical storms were ordinarily unknown in Arin, though they were of common occurrence in Voris, where the atmosphere was cloudy during a great portion of the year. But now the inhabitants of La-dar were treated to an electrical storm of terrifying magnitude. Great flashes of blinding light marked each passage of an orange ray, and terrific peals of thunder followed every flash; the air being disintegrated by the expended energy, and the electricity thus liberated immediately bursting forth in terrific lightning flashes. The populace was terrified, but no damage had thus far been accomplished by the enemy.

Then there was a lull in the storm and it seemed that the commanders of the fleet overhead were engaged in consultation. Ronal spoke rapidly into the microphones, when he observed that a few of the lights above were moving in the direction of an outlying section of the city. Evidently the attackers had become aware of the fact that the protecting ceiling covered only a portion of the city, and were sending a squadron of their ships to destroy the undefended sections. Ronal warned the various division commanders and instructed them to get all available ray projectors ready for immediate use.

"Andon," he said, turning to the son of Sulor, "have you had news of Princess Ila and of Mirsa?"

* Two hours

* Estimated.

"No, your Highness. And we are much concerned."

Again Ronal experienced a wave of cold fear for the safety of Ila. He suddenly realized that the daughter of Olar meant very much to him.

An etherphone operator reported a squadron of seven aeroliners equipped with ray projectors and ready to take off. Ronal ordered these aloft to battle the invader in the skies. Then there was a new development, for a pillar of fire suddenly sprang from a district about three miles from the palace; the enemy had started the work of destruction outside the limits of the protecting ceiling. All eyes were turned in the direction of the flare, while Ronal shouted orders into the microphones. The beams of a dozen powerful searchlights sprang into action and the shapes of three of the spherical vessels were made out over the area under attack. Then came the orange pencils of light from below, and one of the huge spheres was hit squarely. A pulsating glow surrounded the vessel, but beyond that nothing occurred. Another pillar of flame spouted from the city at the point beneath the three enemy vessels. Ronal turned inquiring eyes to Andon.

"The hulls of Olar's vessels are constructed from a metal which is impervious to the disintegrating ray," he explained, "and they will be able to continue dropping their incendiary bombs without fear of molestation."

Over La-Dar

DISCOURAGED, Ronal wrinkled his brow in thought. Then he made a number of etherphone calls in quick succession, obtaining in turn the chiefs of three of the largest metal-working organizations in Marida. His message to each was the same:

"We must immediately provide weapons to hurl high explosives at the enemy ships," he snapped: "Something on the order of the long-range cannon of ancient days. Or, if your engineers can work out means of hurling such explosives by the use of rays of vibrations, so much the better. But we must have the explosives and their detonators, together with a method of firing them in close proximity to the Vorisian vessels."

A crash nearby told of the destruction of one of the aeroliners overhead. Their ray projectors were useless against the enemy craft, and Ronal ordered the remainder of the squadron to return to its base. The entire northeast section of the city was in flames, but the area covered by the ceiling of vibrations was rapidly growing greater as more of the fan-ray generators were placed in service. Occasional flaming patches on the ceiling above them told of the attempts of the enemy to drop their incendiary bombs through the wall of vibrations. But the metals of which these bombs were constructed were completely disintegrated by contact with the remarkable defensive armor.

There came a call from one of the officials to whom Ronal had talked. "We have fifteen cases of high explosive, Your Highness, with detonators attached. Of course, there are yet no means of firing these at the enemy from below; but why not send aerocabs aloft to drop these bombs on their ships from a higher altitude?"

"The very thing. I shall despatch a squadron of ships at once. Meanwhile you are to proceed as previously ordered."

"We are obtaining some results already, Your Highness. One of our research men claims he has the very motor needed to project the bombs, and will have it in operation in the morning."

"Very good," approved Ronal, "I shall expect to hear from you early tomorrow."

A squadron of speedy aerocabs was despatched to the manufacturing plant, which was some 20 miles from the city, and Ronal instructed the commander of the squadron regarding the use of the hastily-improvised bombs. Meanwhile, another section of the city had taken fire, and building after building was demolished by the disintegrating rays of the Vorisians. Ronal groaned in his helplessness.

Still there was no word from Ila.

An hour passed, and the destruction in the outlying districts continued. Refugees were pouring into the protected central part of the city, and gradually this area became of larger size. The engineers were laboring heroically and additional fan-ray generators were placed in service in rapid succession. Then, with a concussion that rocked the city, one of the enemy vessels that hovered not a mile from the palace was blown to bits. A ship of the bombing squadron had been the victor!

Another and another of the great spheres followed; each going the way of the first in a burst of incandescent particles that illuminated the countryside for miles around the city. A great roar came up from the triumphant refugees in the upper levels, where they were huddled on the stationary platforms between the moving ways. Then the remainder of the Vorisian fleet took alarm at this turn of affairs and shot skyward, where the aerocars of the Arinians could not follow. A little while later, the astronomical observatory of La-dar reported the hostile fleet as having come to rest at about a hundred miles from the surface, well out of the atmosphere of Arin. The defense had been temporarily successful; but nearly one-fifth of the city of La-dar was destroyed and several thousand of the inhabitants had perished.

With the tension relaxed, Ronal left Olitan, his second in command, at the microphones, while he proceeded to the council chamber where sat Torveg with a number of his ministers.

"Congratulations, my son," spoke the monarch: "You have handled the situation well and all Marida is proud of you."

"You observed all, Sire?"

"Yes. The television and the news broadcasts have kept us in constant touch with developments. The idea of the explosives was a master stroke. Who would have thought that so ancient a method of warfare would prove so successful in these times?"

"It was first thought of by Olar," replied Ronal modestly, "I should never have dreamed of it, had not the destruction of Mi-ran been accomplished by similar means. But it seems that it was not expected here by the enemy."

"No," laughed Torveg, "and they hesitated not in retiring."

"But they will return, never fear," replied Ronal, "and, from what Andon and Sulor tell me, I fear we have some surprises awaiting us. Meanwhile, our defenses are rapidly becoming stronger."

There was a commotion at the doorway, and Sulor entered the royal presence. His face was flushed, and he walked unsteadily as he approached the throne.

"WHAT is it, Sulor?" asked Ronal, fear clutching at his heart.

"Lyris," moaned the grief-stricken Keronian: "It is reported that she and the entire household of Mirsa fell victims to one of the bombs of the enemy."

"What?" gasped Ronal, "Then that means that Ila, too —but it can not be? You are sure it is true?"

"It is only too true, Your Highness, for word was brought to us by the messengers you sent. Even now Andon is returning with one of your men to the point where the bodies were found."

Ronal gazed appealingly at Torveg, who had listened sadly to this recital.

"That such a calamity as this terrible war should come

to us is unthinkable," spoke Torveg, "and to think that the beautiful daughter of Olar should be among the first to perish! It is a blow to you, my son, for I perceive that you were fond of this princess of Keron."

"Father, I loved her." And Ronal turned his head to hide his feelings.

There was silence in the council chamber, save for the dry sobs of Sulor.

Torveg bowed his head in sorrow.

CHAPTER IX

Dark Days

THAT night there was little sleep for the people of La-dar and, for that matter, for those of all Marida; while, of all the harassed and bereaved, Ronal was probably the most miserable. Throughout the night he remained at the microphones and screens of his headquarters apparatus, listening to the reports of casualties and watching the work of rescue parties that were busy in the devastated sections. And, all through the long night, there came no word from Andon.

When morning dawned the enemy fleet was seen again descending, and Ronal and his staff watched closely in the screen of the high-magnification television apparatus. To their utter surprise, they saw the fifty spherical ships settle to landings on an arid plain of the dry lands some fifteen miles from the city, where they seemed to be planning an encampment. Then they saw that the occupants of the enemy vessels were disembarking, and that huge quantities of structural materials were being carried to the outside. In the circular area surrounded by the ships of the fleet the Vorisians quickly erected a steel tower the sections of which were fitted together with marvelous exactitude and rapidity. They watched in astonishment while a powerful ray projector was hoisted to the top of the tower and fixed in position, with its reflector directed toward the powdery surface of the plain beneath. Heavy cables were carried from the projector to the interiors of several of the vessels; and then they saw that the ray was boring into the surface of the ground and producing an opening of not less than twenty feet in diameter.

"They are excavating for the purpose of providing underground quarters for their fighters!" gasped Ronal, when the intentions of the invaders became evident.

Then he despatched a squadron of speedy aerocabs with cargos of the newly-manufactured bombs to destroy the tower and as many of the enemy ships as possible. But the Vorisians also were provided with magnifying television apparatus; for it was soon observed that they were aware of the approach of the scouting fleet from La-dar. Immediately, increased activity became apparent, and several pieces of mechanism which had been carried from their vessels were hastily assembled within the circular enclosure formed by the huge spheres. Before Ronal's fleet had arrived on the scene, these new devices began belching forth what appeared to be immense volumes of gas of a faint blue color. The gas billowed upward and outward until it had completely covered the scene, spreading in all directions and rising to a height of about 500 feet. Then it seemed to cohere into a perfectly-formed hemisphere which enclosed entirely the encampment of the enemy; although it did not render them invisible in the screens. The Vorisians bustled about their tasks as before, with no more concern than peaceable workmen engaged in lawful pursuits.

Ronal questioned Sulor regarding the phenomenon, but to no avail; for it was as strange to that Keronian as it was to the Arinians. The prince then put in an etherphone call for Andites but, as before, was unable to reach him. Then came the images of the scouting aeros in the screen, and he watched intently as they circled high above the enemy encampment. A dark object dropped from one of the small ships; when it struck the semi-transparent hemisphere it rebounded (as from a huge inflated balloon) exploding with terrific violence, but harmlessly, high in the air! Another and another followed, as the tiny craft dropped their cargoes in the vain attempt to destroy the work of the Vorisians. Then came the orange rays from the enemy ships, searching the skies for the darting aeros, passing through and out of the protective bubble with ease. Evidently the gaseous bubble would not protect the enemy against the disintegrating beam; but this was not a necessary precaution, since their vessels were constructed of neutralizing materials. And two of Ronal's detail of eight aeros had vanished in the characteristic smoke puffs that followed contact with the orange rays! Defeated, he ordered the remainder of the squadron to return to its base.

Nonplussed over the new developments, Ronal called for a number of scientists with whom he might consult, and he angrily berated the absent Andites for deserting him at such a crucial time.

A flushed and panting individual made his way across the palace roof and approached the prince. It was Andon!

"Your Highness," he blurted forth, "they are not dead!"

"Ila?" thundered Ronal, his spirits rising with the hope conveyed by the words. And Sulor grasped his son tightly by the arms.

"Lyris; our princess; Mirsa!" sputtered Andon: "They are now together in the Royal Hospital. But you must not be too hopeful, for all three are in a state of suspended animation that baffles the physicians. They may never recover."

Ronal waited to hear no more, but obtained immediate contact with the hospital.

"Melis," he asked of the physician in charge, "exactly what is the condition of Princess Ila and her companions? I must know."

"It is a peculiar case, Your Highness," came the measured reply: "To all appearances the three women are dead, as are the father and brother of Mirsa. There is no respiration; no pulse; no organs are functioning, except the nervous systems. It is only by means of the cell-exciter apparatus that we have been able to determine that they are not really dead. And there are many more such in La-dar. The hospitals are filling rapidly with the poor creatures. It is the effect of some gas that the enemy used in the raid."

"Will they recover?"

"It is highly problematical, Your Highness. There are no available means of counteracting the effects of this strange poison, but our physiologists are laboring on the problem. If we but knew the nature of the gas, it might be simpler."

"But we do not, Melis." And Ronal turned from the instrument in discouragement.

A New Development

THEN he conceived an idea, and spoke rapidly to Andon, who was now engaged in telling the story to his father. "Andon," he said, "if a gas has caused this condition of our loved ones, there must be some samples of it on the *CXF*. They will be invaluable to our scientists, in saving lives. Go—go quickly to the ship and obtain one of each of the various types of bombs stored in her compartments. The ship is unharmed; for it was within the area of the protective ceiling."

Andon's face lighted at the words and Sulor raised his

head in renewed hope. "I go, Your Highness," exclaimed the young Keronian, and he hastened from their presence.

"Your Highness," spoke up Olitan, from his position at the screen, "here is another marvel that the enemy is accomplishing."

The view in the screen was changed but little. The huge bubble still covered the encampment of the Vorisians. But there now showed a great pit, which had been excavated close to the vertical shaft under the ray projector tower. The pit was round, about a hundred feet in diameter, and half that depth. A number of portable ray projectors had been used in hollowing it out. And, most remarkable of all, from two huge tanks which had been erected at its rim there poured streams of sparkling water. The pit was rapidly filling to form a small artificial lake.

"Where can they have obtained the water?" ejaculated Ronal.

"They are producing it synthetically, Your Highness," was the soleman reply of Olitan.

Looking more closely, Ronal saw that what he said was true. A disintegrating apparatus was at work, arranging the disrupted atoms into collectors where the protons and electrons were united to form new elements—oxygen and hydrogen. The collecting tanks were connected to a huge retort, which discharged into the tanks at the shore of the pond. The Vorisians were combining the two gases in the proportion of one part of oxygen and two parts of hydrogen, thus producing pure water for their consumption, where none had been available in the dry lands of Arin! This was a process unknown to the Arinians; there were some things for them to learn from the crafty scientists of Voris.

Late that afternoon, the second fleet of fifty vessels arrived and another attack was made on La-dar. This was highly unsuccessful, for the protecting ceiling was now complete. But the counter-attack of Ronal's aeros, of which there were now twenty-five, equipped with ray projectors and high-explosive bombs, was likewise unsuccessful. The second fleet from Voris retreated quickly to the protection of the bubble in the dry lands; then the first departed, leaving behind nearly ten thousand fighting men of Voris, who kept doggedly at whatever devilish work they were engaged, below the surface of the dry lands.

A State of Siege

DAY after day the enemy continued with their labors, and each attack of Ronal's forces showed more clearly to the defenders how impregnable was their position. There were now about 20,000 Vorisians at work and, with alternate trips of the two fleets, it was expected that this number would be augmented by another 10,000 every twelve days. Undoubtedly, they were tunneling beneath the surface with the intention of coming up under the city of La-dar where the protective ceiling would be of no avail.

Scouts were repeatedly sent out under cover of darkness to learn what they might of the nature of the protective bubble of the Vorisians and of their workings within its confines. But these scouts never returned to tell of their experiences.

Transmitting beams had been perfected, to hurl the high-explosive bombs at the enemy; and these were tried out in vain against that impenetrable bubble in the dry lands. Then came the return of the enemy fleet with another ten thousand fighters; and a cloud of aeros went out to meet them, carrying the new beam generators and a plentiful supply of bombs. But once more the forces of Arin failed; for now each of the enemy's spherical ships was enclosed by its own gas envelope, and the protection was as complete as that of the bubble surrounding the encampment. The reinforcements were landed without the loss of a single vessel of Voris, while the Arinians lost many aeros and one hundred and eighty men. The people of La-dar became panicky, and their fear was communicated to the far corners of Arin through the reports of the news broadcasts.

Ronal held daily consultations with the foremost scientists of the realm. Many schemes for overcoming the enemy were proposed and, one after another, rejected as impracticable. The prince missed his old friend and tutor acutely during this period, and began to fear for his safety.

Then, too, there was Ila; and Ronal's heart ached when he thought of her, so white and still in her hospital bed. All efforts to analyze the gases obtained from the *CXF* by Andon were fruitless. And, each day, the bodies of the totally-paralyzed victims grew less responsive to the cell-exciters. It was generally conceded that the Princess Ila, like some four hundred other patients who were in similar condition, had little chance of recovery.

Ronal's spirits approached the nadir of despair and, were it not for the comfortings of wise old Torveg, he would have been tempted to give up in hopelessness.

CHAPTER X

The Return of Andites

IN La-dar there were now more than fifty thousand men and women trained in the use of ray pistols and the heavier projectors, which appeared to be the most effective weapons for use in hand-to-hand conflict. And it became certain that the war was to develop into a series of such engagements. Scouts reported that more than a hundred thousand Vorisians were now in Arin; and three more of the bubble-protected strongholds had been established in widely-separated portions of the planet. In each case the enemy's encampment was located within a few miles of the capital city of a great province, and all efforts of the Arinians failed to rout the Vorisians from their positions. Additional space fliers had been constructed in Voris; and the ranks of the invaders were being swelled at the rate of ten thousand every five days. All small communities throughout the globe were abandoned, their inhabitants flocking to the larger cities where the defenses were being organized. The overcrowding which resulted caused great hardship, and further served to increase the demoralization of the frightened masses of the populace.

In anticipation of an underground attack on La-dar, Ronal had ordered the construction of defenses far beneath the ground level. Hundreds of engineers were at work with their boring rays, honeycombing the ground with tunnels and caverns where defensive armor and huge beam generators were set up. A constant vigil was maintained, by means of sound detectors which would indicate the close approach of enemy workings; and it was planned to meet them when their tunnels were broken through and to engage them in a hand-to-hand struggle.

But, faced by an endless supply of reinforcements arriving from Voris, it was apparent that the war was to be long drawn out. For the population of Voris was more than five times as great as that of Arin; and Olar had an almost unlimited number of fighters to draw upon.

Meanwhile, unknown to Ronal, old Andites, keeping constantly informed of the state of affairs by means of his broadcast and television receivers, was hard at work in his secret laboratory in one of the long unused sublevels of La-dar. Nearly three months had passed since the first battle of the war; and long hours of labor and lack of sleep had caused a great change in the old savant. He was pitifully thin and haggard. But his mind was

keener than ever, and today there was a gleam of satisfaction in his tired gray eyes.

"Ah, at last," he muttered, as he completed the final adjustments of a mechanism that reposed on one of his work benches. "I have discovered the secret. Arin is saved—until the great cold."

HIS fingers trembled as he inserted a small lump of clay in a tiny crucible, which he placed on a small platform. Above this platform was a series of vacuum tubes, each of a different shape, and each connected to the apparatus by many wires of large diameter. He closed a switch, and the musical hum of a powerful dynamo machine beneath the table responded. Then he manipulated a number of dials on the face of the apparatus and, when these were adjusted to his satisfaction, he pressed a button which lighted the many tubes over the little crucible. From each tube there shot a ray of different character, some red, some blue, some of dazzling whiteness. All rays converged on the tiny lump of clay, and a wisp of smoke curled upward from the container. Then there was a roar as of a terrific windstorm within the confines of the crucible, and Andites laughed aloud in his glee. He opened the main switch and the dynamo stopped, the light of the several tubes fading. But the roar in the crucible continued and, with a thick sheet of asbestos held before him to protect his body from the intense heat, Andites stepped to the platform and gazed into the miniature inferno he had created.

The tiny lump of clay had become a whirling fury of dazzling brightness and, as it spun madly within the crucible, its radiations produced strange effects in the large room which was Andites' laboratory. The walls trembled and the very air pulsated to the intense energy of the minute sphere of tortured matter. The walls of the crucible became incandescent and the radiated heat was so intense that Andites retreated to the far wall of the room. Then, as the roar of the energy mounted to a volume that nearly shattered his ear drums, the crucible and its demoniac contents vanished in a puff of flame and with a jar that shook the foundations of the building. Andites gazed spellbound at the empty platform for a moment, then rushed from the room.

He hastened to his living quarters and removed his soiled clothing. A cold mist shower put new strength in his tired body, and he attired himself carefully for the important visit to the palace. He was consumed with eagerness to impart his astounding news to Ronal, and lost no time in making his way to the military headquarters of the young prince.

"Andites!" exclaimed Ronal, when he looked up from one of the television screens and encountered the gaze of his friend. "I had just about given you up as lost. But truly, it is good to see you once more!"

And, before the eyes of his astonished staff, the young prince leaped to his feet and threw his arms around the body of the older man, hugging him enthusiastically as he had been wont to do when a mere lad.

"It is likewise good to see you, my Ronal." The eyes of Andites were softened and happy, as he looked into those of the prince.

"Where have you been, my Andites? And what have you been doing?"

"I have been at work in my hidden laboratory, my lad. And a momentous discovery has resulted—a discovery that will rid Arin of the menace of Voris!"

"You mean . . . ?"

But before Andites could reply there came an interruption. The great alarm siren of the palace let forth its wail of warning and all eyes turned to the viewing screens that pictured the underground defenses of La-dar. The enemy had broken through!

A Temporary Advantage

INSTANTLY Ronal gave his every attention to the microphones, and Andites stood proudly by as the young commander barked his orders into the instruments. Ten thousand fresh troops of La-dar were converging at the point where the tunnel of the Vorisians had entered their own workings. The scene in the viewing screen was one of indescribable confusion, as hundreds of fighting men crowded into a cavern which became so closely packed that the ray pistols were almost useless. Hand-to-hand conflicts developed, and the noise of the mêlée, as it came through the amplifiers, was deafening. Then a puff of smoke showed in the cavern, and for a few moments all sight was obscured, though the shouting of the combatants continued unabated. Then there was an ominous stillness and slowly the smoke cleared away, drifting leisurely through connecting tunnels toward the outer air. And what a sight met the eyes of the observers when they were again able to discern the objects in the cavern! The fighters of La-dar were stretched lifeless; and only then was it seen that the Vorisians wore small gas masks that covered mouth and nose and thus saved them from what lethal gas they had released.

Ronal warned his lieutenants immediately, and four companies were directed to advance along connecting tunnels, behind the armor of neutralizing metals which had been provided on their high-power movable ray projectors. Soon there came the flash of a beam that cut a swath through the massed troops of Olar, and accounted for a full hundred of them before they were able to erect their own protective screens. Then, proceeding behind the insulating covers, companies of the invaders streamed into the connecting tunnels and advanced on the waiting Arinians.

One of Ronal's aides was plotting a line on a chart and he called the attention of the prince to what he had done.

"See this, Your Highness," he said: "This is the location of the cavern, and the enemy's tunnel extends in this direction toward their headquarters in the dry lands."

Ronal examined the chart and wrinkled his brow in thought. "The elevation at their headquarters?" he asked.

"Minus twelve feet, Your Highness."

"And of the lower levels of La-dar?"

"Plus fifteen feet. That is, not counting on the depth of the recent workings."

"Good!" And Ronal became a whirlwind of energy.

HE dispatched a corps of engineers to the great canal at the point where the enemy tunnel crossed its broad width. Rapidly he issued instructions for them to open a huge gap through the intervening ground with their ray projectors. Then he commanded the troops under the city to retreat slowly, using every effort to keep protected and to hold back the advancing enemy as long as possible. Ray projectors were to be kept in constant action to beat back the gas fumes as they were released from the Vorisian bombs. The caverns and tunnels were filled with the advancing hordes of Olar and they were pressing steadily forward, searing tunnel walls and floors with the heavy discharges of their disintegrators. On either side it was certain death for a fighter to expose any portion of his body beyond the edges of the screens. And here and there the gas gained headway, leaving always in its wake a heap of lifeless Arinians. The gas masks of La-dar proved useless against these strange vapors, while those of the Vorisians seemed effective in protecting their wearers against all gases used by the defenders.

Ronal manipulated the controls of the television, and on the screen appeared the view of the great canal where his engineers were at work. Great clouds of steam rose from the dark waters as the projectors bored deeply into the bed of the canal. Then there was a shout from the workers and the steam clouds drifted away, leaving a whirling eddy in the waters whence they had emanated. The great canal was pouring into the tunnel below.

There was consternation in the enemy's ranks when the water came rushing in upon them, and those on the near side of the point of influx were of necessity compelled to continue their advance toward the city. Those on the far side beat a hasty retreat in the direction of their headquarters in the dry lands, being forced, eventually, to the surface by the rising waters.

Now the defenders were putting up a terrific resistance to the invaders, who found themselves between the advancing waters and the suddenly invincible Arinians. As the Vorisians were forced into the higher levels under the city, they were flanked by company after company of Ronal's troops, who poured the deadly rays of their disintegrators into the struggling invaders from the several tunnel mouths that entered at many points behind protective screens.

Ronal sent a fleet of aeros to the enemy headquarters in the dry lands; and these hovered expectantly over the great bubble, keeping close watch on the Vorisians as they poured in great numbers from the shaft mouth and retreated to their spherical vessels. Then came the waters, gushing from the mouth of the pit like a geyser. The generators of the mysterious bubble ceased functioning as they were flooded. Then came a rain of high explosives from the vessels of Arin, and six or seven of the huge spheres were blasted out of existence. But the rest had managed to surround themselves with the protective gas; and these rose rapidly to attack the Arinian fleet, bringing about the destruction of fully twenty of the smaller craft before a retreat could be organized.

The battle beneath the city still raged furiously, but the defenders were emerging victorious. Ronal turned happily to face the solemn eyes of Andites. He exulted openly.

"It was a great idea, my Ronal," approved Andites, "but it is no more than a temporary setback to the enemy. Olar can outnumber us by five to one and he has but begun his campaign."

"True," admitted Ronal. And his face fell. "But how are we to outmaneuver the tyrant?"

"By destroying the planet Voris," whispered Andites.

"Destroying it? Annihilating an entire planet?"

"Exactly."

"Can this be done?"

"It can. The discovery of which I spoke provides the means."

Ronal gazed wonderingly into the honest eyes of Andites, unmindful of the jubilant reports of victory which were coming in from his various lieutenants. But he did not forget to order the canal bottom repaired, to conserve the precious water.

CHAPTER XI

Reverses

THE battle beneath La-dar raged for three days. No quarter was asked and none given; and eventually the last remnants of the invaders were exterminated. But it was at terrible cost to the defenders, for not less than twenty thousand casualties were counted. There was mourning throughout all Marida, and jubilation over the victory was not to be thought of.

The enemy had established a new base for operations on the other side of La-dar; not more than five miles from the city limits, where no canal intervened to permit of a repetition of the first repulse. In making this move, the Vorisians were harried and attacked by hundreds of the newly equipped vessels of Marida, and they lost one of their huge spheres during these encounters. But the new headquarters was successfully established and eleven of the Arinian vessels and their crews were destroyed.

Andites was given a free hand in the carrying out of his scheme, and was laboring incessantly with the research engineers of several of the large manufacturing corporations. Crates of heavy machinery began to arrive at the observatory of La-dar within five days of the time of starting work, and the erection of the new apparatus went forward with unprecedented speed.

The air was filled with urgent messages from the high-power radio transmitters of the enemy, but these were unintelligible to the people of Arin; for it had not been found possible to decipher the complex code. Neither was it possible to rectify the distorted modulation of the low-power etherphones and thought projectors used by the Vorisians for carrying on their inter-headquarters communications, though Andon had used the apparatus of the *CXF* in his efforts to do this. The characteristics of the distorting mechanism had been altered after the loss of the *CXF*, in anticipation of just such attempts by the people of Arin.

Ronal spent much time at the hospital in consultation with the physicians and at the bedside of Ila. Of the four hundred patients originally under observation, more than three hundred had passed from the state of suspended animation into the decay that means death. But Ila was one of the few who still maintained evidence of susceptibility to cell-excitation, and, though she gave the appearance of a lifeless marble statue of divine beauty, there was still the possibility that she might eventually be saved. If only the scientists could determine the exact nature of this peculiar affliction! Then, thought Ronal, they would be in a position to determine a means of effecting a cure. He must talk to Andites about the matter. His hopes rose at the thought, but were dashed when he gazed at the still form of the daughter of Olar. Surely there was no hope, when already more than three-fourths of the victims had perished. And strange it was that he, who had never interested himself in the fair sex, was so deeply and hopelessly enamored of this beautiful princess of Keron. Stranger still, that he should be planning the destruction of her home planet, her father's death.

THEN came news of the direst disaster of the war. Pulans, the magnificent capital city of Orsto, was occupied by the enemy. Pulans, second only to La-dar, a mass of ruins, with eighty thousand of its inhabitants slain! The remaining four million or more of its people were placed in a degrading subjection to the tyrant of Kir! Ronal ground his teeth in futile rage. And, every two or three days now, fresh troops arrived from Voris; there were now estimated to be more than two hundred of the spherical space cars making regular round trips between the two planets. Each day the activities of the enemy increased in magnitude and ferocity. Truly, the one course left open for the salvation of Arin was the utter destruction of Voris and its conquest-mad millions.

Torveg seemed to age many years in those terrible days, during which the victories of the armies of Olar became more and more widespread and devastating. He trembled at thought of the fate of the twelve million inhabitants of La-dar; for he realized that the Vorisians would be successful in overpowering their inadequate defenses. He

wept over the reports of indignities heaped upon the people of Pulans; over the wanton destruction of priceless works of art; over murder and rapine. Five other large cities of Arin, having populations of between three and four millions each*, were in imminent danger of occupation by the relentless foe. Things looked very dark indeed for his beloved subjects. He refused to be comforted by the assurances of Ronal that Andites was working out their salvation in the laboratories and factories of Marida. Not a scientist at heart, he was unable to appreciate the possibilities inherent in a new discovery.

Andon and Sulor were assisting Andites, and labored day and night in the effort to hasten the destruction of Olar. They were vengeful and bitter, and the long hours of deep concentration seemed to aid in relieving somewhat their sorrow over the fate of Lyris. They had long since given up hope of her recovery, though the beloved wife and mother remained in about the same condition as did the princess Ila.

The Origin of the Asteroids

IN the great dome room of the observatory, Andites was completing the final adjustment of the complicated apparatus that had been installed near the supporting pillar of the huge reflector. He smiled with satisfaction when he found that all was in excellent working order. The many careful workmen who had by their united efforts made possible this triumph of engineering had done their work well. The time was at hand!

Andites stepped to the etherphone and quickly obtained a connection with the palace.

"Ronal," he said, exultantly, when the voice of his beloved prince responded to the call, "All is in readiness. This is the night of the great accomplishment. Come to the observatory at once and bring Torveg with you."

"The power connections are complete?"

"They are, my Ronal. The entire generating capacity of Marida has been linked together in one great superpower system. We have the power of more than nine billion men** available."

"You are certain of success, Andites?"

"Positively. If this scheme fails, then I would be willing to admit that mathematics and its allied sciences are fallible and natural laws are disproved. No, my Ronal, there is no possibility of failure."

"I trust that you are correct. And I have no cause to doubt you now, my Andites, for you have never spoken anything but truth. We will proceed to the observatory at once."

It was just before midnight, and Voris shone faintly, high in the heavens. The great reflecting telescope was trained on the planet, and the clock in its massive pedestal kept the orb in constant view. Andites peered earnestly into the eyepiece and made a slight adjustment to center the body exactly with the cross-hairs. He stepped to the many-paneled switchboard and checked the multitude of feeder switches where the incoming power beams conveyed their vast supply of energy to the main busses. All was in order. He rubbed his palms together in an anticipatory excitement. He gazed upward to where the outer end of the telescope pointed toward the broad open slit in the dome, and he thought grimly of the power that was to spout forth from the massive sixty-foot iridium ring that surrounded its tip. No human being in all Arin, save only Andites, knew what enormous forces were to be released when the main control of his apparatus was closed.

"WE have arrived, Andites." The voice of Ronal greeted him close by, and he turned to observe that the royal party included a number of distinguished personages, in addition to Torveg and the young prince.

"You are welcome, Highness." And Andites, with a smile, stood stiffly at attention.

Torveg glanced nervously about him at the gleaming contrivances that seemed to lurk everywhere in the shadows of the immense dome room. "Do I understand, Andites," he asked, "that you believe this new mechanism of yours will destroy the planet Voris?"

"That is correct, Your Majesty. And I shall demonstrate it in a very few minutes."

"If it works—if it works," muttered Torveg incredulously, "our people are saved. For the quarter-million Vorisians now in Arin will perforce surrender. Their home destroyed, they will have no source of supplies, no further reinforcements. The radium* from which their energies are obtained will run short and there will be no means of replenishing the supply. Yes—they must surrender—yet it seems a pity that Voris, once the home of a magnificent civilization, should be utterly destroyed because of the sins of its present inhabitants."

The great ruler of all Arin shook his head solemnly. But Ronal and the nobles of his court voiced strenuous objection. It was no time to waste maudlin pity on an enemy who threatened the very existence of their own civilization. Andites chuckled, as he advanced to the lower end of the telescope and attached a shining cylinder to its eyepiece. Then he pressed a button and the dome room was in darkness save for the brilliance of the image of Voris projected through the metal cylinder to the surface of a vertical screen. A deathly stillness fell over everything, a silence broken only by the sound of Andites' feet as he stepped to the switchboard and pulled a lever that clanked ominously as it swung to its closed position.

On the screen Voris was pictured as a brilliant orb some six feet** in diameter, its oceans and continents standing forth in bold relief. But the eyes of the observers were drawn skyward by the sound of a throbbing roar which was set up by the throwing of the main switch—a roar that told of more than a billion and a quarter horsepowers*** of energy projected into space. Through the slit of the dome they could see a pulsating violet beam that extended far into the blackness of the heavens and in the direction of Voris.

The voice of Andites came hoarsely as he raised it to make himself heard over the now deafening uproar: "The beam which has set forth on its long journey to Voris will reach there in fifteen minutes**** It carries tremendous energy that will penetrate to the vitals of the planet, and there set up a progressive atomic disintegration that will accomplish our purpose. This is the secret of the new apparatus. The disintegration is internal, not external, as in the case of our regular disintegrator rays. These could not be used; for the energy required would be many millions of times greater than could be generated in all Arin. But with the atoms in the heart of the planet once disrupted, they will continue their work of destruction without further aid. Being confined under tremendous pressure, the exploding of one atom will set off the next adjacent one, then the next and the next, *ad infinitum*. The

* Estimated from ruins and all other available evidence.
** Undoubtedly the Arinians had their power units based on what work an animal could do. Our own unit is based roughly on the power of a horse; theirs on the power of a man.

* In the thought message the expression conveyed was "the metal of fiery power that constantly loses its substance."
** Again estimated. The thought conveyed was "a man's height in diameter."
*** Roughly equivalent to nine billion man power.
**** The phrase used here was "the eighth part of a unit." Remember there are 12 units in an Arinian day.

internal heat of the planet will increase so terrifically, and so rapidly, that the crust will be unable to withstand the pressure; and an explosion of enormous magnitude will result."

THEY watched breathlessly—endlessly, it seemed.

"The beam is at work," Andites eventually announced.

Another period of waiting. The clear image of Voris as seen on the screen did not alter in the slightest degree. Minutes passed; minutes that seemed like hours. Then a huge crack appeared across the surface. Another and another followed in quick succession, and the watchers gasped as the physical contours of the continents underwent rapid metamorphosis. Dense clouds of steam belched forth from the fissures which soon widened to yawning chasms. The entire planet was obscured by the billowing clouds of vapor. Then came a burst of vivid flame from out the swirling whiteness, and great sections of the globe were flung off in all directions, heated to a dazzling incandescence by the fury from within. Wabbling uncertainly, these masses went hurtling off into space. Another huge burst of flame—more flying fragments—and Voris was no more.

Then came that reaction which Andites had anticipated, but which brought consternation to the watchers and spread terror throughout Arin. The ground shook. Roaring winds howled with demoniac fury. The heavens spun round crazily and, in the space of a few minutes, the sun rose—fully four hours ahead of time!

The unexpected rays of the morning sun, flashing suddenly through the slit of the dome, fell across the awed group near the greater reflector. In their midst, on the hard floor, knelt Torveg, tears streaming down his furrowed cheeks. In faltering and well nigh incoherent whispers, now audible in the sudden stillness, he gave thanks to his Maker.

CHAPTER XII

Peace

LONG after the royal visitors had left the observatory, Andites remained at the telescope with one of the staff astronomers. Many observations were made and much data compiled regarding the new order of things in the solar system. Voris was no more, and its fragments had gone to make up a great number of new small bodies, each with its own independent orbit. Of these there were at least eight hundred, and possibly as many as a thousand. The disturbance to the solar system occasioned by the redistribution of forces was slight, though its effects had seemed tremendous to the lay populace. Arin was shifted from its normal orbit by but a few thousand miles. The inclination of its equator to the plane of its orbit had been altered not more than one degree. But the momentary resultant of the many changing forces had been so terrific as to turn the planet on its axis almost ninety degrees in the direction of rotation, thus accomplishing in a very few minutes what ordinarily took place in one-sixth of a day, and thereby causing the sun to rise four hours sooner than usual on that eventful morning. The rate of rotation seemed not to have permanently altered, however; so it was not expected that any great change would be experienced in climate or in other physical conditions. But one set of observations caused Andites to ponder very deeply, and he suddenly left his companion and hastened to the palace to communicate to Ronal his startling conclusions.

Passing through the upper ways, he found that confusion reigned throughout La-dar, though the public news broadcasts blared forth reassuring announcements at each intersection.

"Ronal," he stated mysteriously, when he had been admitted to the chambers of the young prince, "this disturbance in our solar system has saved us from the greatest disaster of all, or at least postponed it for many, many centuries."

'Why, what mean you, Andites?"

"The great cold that I told you was coming. The path of the solar system through interstellar space has been altered—very slightly, it is true, but still sufficiently so that we shall miss the first great gaseous nebula that was to rob us of our carbon dioxide*."

"Then Arin is to survive indefinitely after all?"

"Not indefinitely, but the time of the great cold will be greatly delayed until a second and larger nebula must be encountered."

Ronal smiled in spite of himself. "That should give us little concern at the present moment, my Andites," he chuckled: "You and I will long since have been forgotten when that time comes."

"True!" Andites wagged his head sagely: "But there is still an important problem to be considered for the benefit of future generations."

A PAGE interrupted their conversation, handing a scroll to the young prince.

"H—hm," muttered Ronal, when he had glanced over the writing. "Malick, commander of the forces of Olar, is suing for peace. One of their bases was destroyed by earthquake at the time Voris exploded. One hundred and ten vessels of his fleet were destroyed with the planet, for they had just arrived there from Arin. Supplies are already low in their encampments; they must yield."

"It is as we expected. They are cowards at heart. And do you intend to spare them?"

"What else can we do? We are compassionate beings and must show mercy, else we ourselves become miserable. But they will make good laborers in the mines and factories. Yes, I shall spare them."

Ronal paced the floor in a state of intense feeling, and Andites regarded him with understanding eyes. "You will send word at once?" he inquired.

"Malick awaits my reply in the open square atop the palace. I go to him immediately."

And with these words he strode from the room and made for the lift, Andites following him closely.

Awaiting his coming was a delegation comprising not less than twenty Vorisians, the figure of the commander conspicuous by his ostentatious display of medals and other decorations. And a thoroughly cowed and dejected lot these survivors were.

"Your Highness," inquired Malick, "has read the scroll?"

"I have." This from Ronal in his most haughty and condescending manner.

"You will offer terms of peace?"

"Yes, but mark you, Malick, they will be hard. We of Arin are soft-hearted, but we must steel ourselves to deal properly with foes such as the Vorisians have proved themselves to be. We did not make this war, but we have ended it; and we propose to settle with your invading armies as we see fit. A truce is hereby declared until suitable papers can be drawn up and signed. Meanwhile you are to surrender your arms, your vessels, and the secrets of the many gases and other offensive means you have used against us. My staff will appoint companies of our troops to take over these munitions and guard your encampments. Your men's lives are to be spared, miserable as they are, and they will be supplied with food and other necessities. But these must be earned by honest toil

* This again is a deduction from a thought impression.

in a manner we shall later prescribe. That is all for the present."

A Last Attempt

HE turned to leave the presence of the delegation of Vorisians, but stopped in his tracks as his eyes rested on an emblem worn by one of their number, a court physician of high standing. Ronal was seized with a sudden idea. He rushed to the astonished Keronian and grasped him roughly by the arm.

"You are a physician?" he barked.

"I am." The startled medical man winced under the pressure of Ronal's powerful fingers.

"You are acquainted with the effects of the gas that causes a state of suspended animation and eventually results in death?"

"Yes."

"You are able to cure victims of this gas?"

"In certain cases. That is, where the action has not been allowed to persist too long a period of time."

"Come with me!" Ronal jerked him unceremoniously from the midst of his companions and hurried him to the waiting elevator. In a few moments they were on their way to the hospital where lay Ila the beautiful, orphaned daughter of Olar.

* * * *

"It is too late," whispered Melis, when questioned by Ronal at the door of the room occupied by Ila, Lyris and Mirsa. "The princess has crossed the border line. Her body is now being prepared for interment."

The young prince went ghastly white and he turned savagely on Tilon, the Keronian physician, who backed away in awe. "You hear that?" shouted Ronal. "It is the princess Ila they say has died—Ila the beautiful, killed by the hand of Olar, as was her poor mother! By the imps of the dry lands, I'll kill you with my bare hands unless you bring her back!"

"Ila!" gasped Tilon, his face as white as Ronal's and his limbs trembling. "She, a victim of the *Bor* gas! But perhaps your physicians do not know. There may be hope. Where is she?"

Quickly he became the alert professional man, and quickly he followed Melis into the supposed room of death.

Ronal was left to pace the halls in an agony of hope and fear. He was in need of medical attention himself, for his nerves were near the breaking point. During many trying days he had obtained little or no sleep, and the climax had been followed by a reaction that threatened to break even his iron constitution. A cold sweat broke forth on his forehead, and he moaned in anguish of body and mind as he kept vigil.

Would they never finish? It seemed that hours of deathly stillness had already passed. And still there was no sound from behind that spotlessly white steel door. He would keep his word and throttle the life out of the pampered doctor from Olar's court. Yes, a thousand Keronian warriors should pay the penalty if Ila had indeed passed on! He would break his word to Malick—they were a vile, worthless lot, anyway; and the lives of a million of them were not worth the wee finger of Ila's hand. The door opened, and Ronal stopped in his pacing as if halted by the discharge of a ray pistol. Melis approached him. Was he smiling or dejected? Name of the imps, he *was* smiling! Ronal grasped him by the shoulders and shook him roughly.

"Tell me! Tell me!" he exclaimed, "will she recover?"

"She will recover, your Highness. But, if it please you, I wish to be released. There are still thirty of our people who might be saved—now that we have the method."

"To be sure. To be sure." Dazedly, Ronal released his grip and watched the busy physician hurry into the adjoining room. Then he stepped to the door of Ila's room and cautiously peered within. Tilon was bending over the figure of Lyris, who lay on the adjoining bed. Ila, he saw, lay white and quiescent beneath her own snowy covers. He advanced quietly to her side.

Wonder of wonders, the long lashes lifted! The great eyes opened wide. The princess recognized him. She smiled; a smile so sweet and tender that Ronal dropped to his knees at her bedside and gazed and gazed in awed thankfulness.

"You are able to speak?" he whispered.

"A little, my prince," she replied weakly: "How long have I been ill?"

"Many days, dear. But now you are coming back. You are to be well once more. And never again shall you leave the side of Ronal."

"The war?"

"Is over. But you must not think of that now. You must think only of getting your strength back."

"Voris was defeated?"

"Voris has been completely destroyed, sweetheart. There is nothing more to fear."

A wave of color mantled the exquisitely-chiseled features as Ila heard the word of endearment. At the moment she looked as if she had never been ill a day in her life. Suddenly she moved her fingers, reached for his hand.

"You love me?" she asked.

"More than my life. It is too much to hope that you likewise love me."

Her eyes answered him. Then she sighed and, pressing his hand tightly, fell into a natural sleep. He stood erect and tiptoed softly to the side of Tilon, who looked up at his approach.

"Thank you, Tilon," he said: "You have given Ila back to me. I love her, you know."

"Hm," grunted the unimpressed Keronian: "Many loved her in Voris. But she would have none of them. I suppose you are to be congratulated. Anyway, I am glad to save them all. The others also will recover."

And he went about his business unconcernedly. Ronal stared at him in amazement. It seemed to him at that moment that the entire universe should be singing to the tune that was in his own heart. He gazed once more at the beloved features of the princess, then dashed madly for the lift. He must break the glad news at once to Torveg, to Andites, to Barlo! And the happiness that was to come to Andon and Sulor!

There was now no need of a physician for Ronal. His cure was complete.

Epilogue

HERE ended the Martian "thought book" which so appealed to the author. Others of these remarkable histories, which came to us after ages of time, tell of the wise rule of Ronal after the death of Torveg, and of the great love he bore his consort, Ila the beautiful. They tell of succeeding generations and the peace and prosperity that reigned throughout Arin to the end, when the great cold eventually came in accordance with the predictions of Andites. But, in all this collection of ancient information, there is no story so appealing as that of the two young people of royal blood whose lives were so closely associated with the events of that last great war; a war responsible for the removal of a planet from our solar system and the substitution of the asteroids which were formed from its fragments.

That the existence of warm-blooded animal life on the

(*Continued on Page* 931)

The Color of Space

By Charles R. Tanner

(Illustration by Paul)

Henshaw approached the window, his incredulity vanishing

DR. HENSHAW faced his captor wrathfully.

"Have you kept me here, doped for a week?" he began. The Russian interrupted him with a quieting gesture.

"Wait, Doctor," he said, "there is much that must be explained before you indict me. Have you no curiosity regarding your kidnapping or this room in which you find yourself?" His eloquent gesture took in the strange metal walls, the two doors and the immense, shuttered, circular window that covered almost all of one wall.

"I think I understand clearly why I was kidnapped," growled Henshaw. "It's that secret process of mine. Russia and France have both been making frantic efforts to persuade me to sell. But I won't."

"Really, Doctor. After my explanation I do think you will agree to *sell* it to Russia. Much has happened in the week that you have been unconscious." And seating himself in the room's only chair, Godonoff went on:

"The day after I —er— kidnapped you, a series of events were started, resulting in a war in which Russia faces the rest of Europe. Troops have massed on the Polish border, and the powers expected to invade Russia immediately. Then suddenly news came from Paris that the Eiffel Tower had disappeared! Was this the work of Russia? Hard upon this news came the reports of the disappearance of the Nelson monument from Trafalgar Square, in London, and of the Woolworth Building torn from its foundations in New York. That turned the tide. Panic attacked the Powers. I'm afraid the morale of your Western nations is crumbling now, Dr. Henshaw."

"What's the explanation?" asked Henshaw, dazedly.

"Just this, Doctor," the Russian answered: "Our scientists have succeeded in overcoming gravitation! Eight years ago, two of our scientists, while attempting to disprove the Langmuir theory of the construction of the atom, managed, by the use of terrific pressure, to combine helium and fluorine. As you know, helium has never before been combined with any element. The result was a dark green solid that was absolutely weightless. *And further investigation showed that an electric current passed through it caused an absolute negation of gravity.*

"Armed with this great weapon, our government began the construction of three great ships, designed to fly through the atmosphere or, if necessary, beyond it. The first was one hundred meters in diameter, and was such a success that the others were made four times as large! It is these vast machines that have stolen those great buildings! What do you think will be the effect, Doctor, when Russia tells the Powers tomorrow to search for their lost buildings on Venus? Do you think they will feel like going to war with a nation that can accomplish such miracles?"

"Do you expect me to believe you?" asked Henshaw cynically.

Godonoff rose and moved over to the huge circular window. He began to turn a wheel that opened the window's metal shutters.

"Due to certain work which I had accomplished in America," he said, "the government honored me by placing me in command of the smallest of the machines. In order to secure your secret, Doctor, I took the liberty of bringing you along when the machines left for Venus. You are now 170,000 miles from the earth, and travelling fast. I offer you your return in exchange for the secret."

Still smiling, Godonoff released the wheel and turned to Henshaw.

"And, Doctor, if you care for proof . . . " and he gestured toward the now uncovered window.

Henshaw approached the window, his incredulity seemingly vanishing as he gazed at the stupendous scene without. Stars—millions of stars—covered the entire view. Above, below, everywhere, stars swung in a mighty sweep around him from left to right as though the entire heaven were spinning like a stupendous top.

And as he gazed, earth and moon swept into view. The latter was almost hidden behind one of two disc-like machines that hung between the earth and Henshaw's viewpoint. The doctor caught a glimpse of a great brassy reflecting surface, a central apparatus resembling a solar

$300.00 PRIZE CONTEST

FIRST PRIZE $150.00
Awarded to
THE COLOR OF SPACE

By

CHARLES R. TANNER
1841 Fairfax Avenue,
Cincinnati, Ohio

Mr. Tanner is 33 years old, is married, has two children and since the age of eight has wished to be an author. He has read all of Mr. Gernsback's magazines since the MODERN ELECTRICS *of 1908.*

engine, and tremendous tentacles that held a huge building in their grasp. Then machines, earth and moon had swept past the window and only the stars appeared.

When he turned, he found the Russian beside him, looking over his shoulder.

"Are we—rotating?" Henshaw asked, his disbelief turned to awe.

"Yes," Godonoff nodded, "the centrifugal force of our rotation is what gives the effect of gravity in the car."

As Godonoff spoke, earth, moon and the great machines again swept into view and this time, Henshaw was able to secure a better view of them. He saw that the building in the grasp of the foremost machine was really the Woolworth, and that the farther one held the Eiffel Tower in its arms.

The machines swept out of view, but in a few minutes appeared again. Godonoff began proudly to explain them.

"That brass surface reflects the greater part of the sun's rays. Although space is intensely cold, when the rays strike directly on anything, they heat it up to a remarkable degree. As you see, we reflect most of the heat from the machine's surface; what we need is absorbed by the solar engine in the center. Note the curved mirrors which reflect the heat to the central cylindrical steam boiler. The steam generated runs the turbines that generate electricity to heat and operate the whole machine.

"See that green globe in the middle of the machine?" he continued as the machines swung past again, "that's the helium fluoride. An electric current is passed through it, when we first leave the earth, but, after a good speed is secured, our inertia carries us on."

"What are those two searchlight beams?" asked Henshaw.

"They are not light beams, Doctor. They are hollow cones of gas, lit up by the sun. The helium fluoride is not a stable substance; it slowly decomposes into its elements. The resulting gases are forced through pipes and through the boiler of the solar engine, where the heat expands them and drives them at high pressure through the nozzles you see. The recoil of the resulting jets is used for steering the disc."

Henshaw turned back into the room, his eyes dazed by the view of the rapidly revolving heavens.

"That door," he said, pointing, "it leads to outer space?"

The Russian eyed him narrowly and then nodded.

Charles R. Tanner

IN awarding Mr. Tanner the first prize of $150.00 in our very interesting cover contest, we were impressed, in the first place, with the excellent way in which he developed his story. It is a pity that too few science fiction authors consider the story or fiction element of their work to be important enough to demand a great deal of careful thought and preparation.

We want emphatically to encourage these writers, who have the knack of developing an interesting story, one that carries you breathlessly through its incidents and comes to a natural climax.

Mr. Tanner further was not content to take the cover at its face value, but he tried to analyze its meaning and penetrate its possible significance. This he does in a very convincing manner and we think our readers will agree that the startling conclusion to his story was foreshadowed by what went on before.

Mr. Tanner is, we believe, a newcomer to science fiction; yet by the exercise of his splendid powers of observation and facility for developing incidents, he can become a writer of no mean excellence.

"I suppose you've bolted it," Henshaw went on smilingly, "so that I can't leap out into space and take my secret with me?"

"Oh, no," Godonoff answered. "It was locked when we left the earth, and I've just left it that way. I'll unlock it, but don't think it can be opened. With fifteen pounds of air pressure on this side and a vacuum on the other, wild horses couldn't open it."

As he spoke, he unbolted the door and stepped back, smiling. Like a flash, Henshaw flung himself at the door, and jerking it open, fled through. Darting down the long hall in which he found himself, he tore open another door, and before Godonoff could gather his startled wits, he hurled it open and was out! . . . Finding himself in a well-lighted, well-populated street, Dr. Henshaw walked calmly away.

The next day, an admiring group of reporters listened in amazement to Henshaw's story of the kidnapping.

"Godonoff's story, the metal room, and all the rest were just staged to put me in the proper mind to divulge my secret," he said as he finished. "The scene that I witnessed through the window was probably a cleverly designed motion picture. You know how uncannily natural these Orthochromatic stereopictures are."

"But, Doctor," interrupted one of the men: "It took nerve to open that door. How did you know that you wouldn't find yourself in interplanetary space?"

Henshaw's eyes twinkled.

"I was quite positive before I opened the door that I wasn't in interplanetary space. In the first place, as the Russian said, if we were in free space, I couldn't open it. Then, when the Russian designed his little show, he made two rather inexcusable mistakes. In the first place, the disc nearest me, when lighted by the sun, would have made a reflection of such an intense brilliance that I would have been unable, even, to look at it. Then again, he pictured the sky as it appears to us on earth—deep blue, and sprinkled with stars. As we know, the bluish tinge of our midnight sky is caused only by the diffusion of the faint starlight by our atmosphere. In space, the sky would appear a black of the deepest jet. Furthermore, there would be seen ten times as many stars as were perceptible from the space ship. Therefore, with these fundamental mistakes in the little drama, I was quite sure I would find a city street beyond that door."

THE END

The RELICS FROM the EARTH

By JOHN PIERCE

I WAS to head the expedition! I had been chosen! It was a great honor for a mere youthful graduate terralogist with no great experience and nothing much to his credit. That is, of course, if you do not count my monograph, "The Last Life Before the Exodus."

Yes, equipped with two great Goznac discs more than 400 meters in diameter, I was to make a trip to the old earth, to head the largest archeological expedition in history. I would bring to our museums a few priceless relics of the almost prehistoric era when man lived upon the insect-ridden earth. We were to attempt to save for civilization those two marvels of ancient architecture, the Eiffel Tower, the tallest structure on earth, and the Woolworth Building, the highest skyscraper left standing. That is, we hoped that the decay which made deserts of the formerly great cities had preserved them intact. Many centuries have passed since we migrated to this peaceful little body, Triton, where we are without that terrible scourge, insect life. As I looked about me before departing, I could hardly realize that man once lived upon another and less fertile planet than this, our present home upon Neptune's greatest satellite.

Before many days we were under way. We shouted to the crowd, shot out the immense handling tentacles and waved to the city as we clanged the hatches shut. With our powerful helio-lights we flashed a last farewell, then braced ourselves at our padded station for the force of the acceleration as we rose with unlimited speed.

A few hours later we were far in space. As the acceleration was gradually decreased, almost to zero, all sensation of weight vanished. I made my rounds swinging through the air. I went to the central dome of the pilot house. There I could see only the objects to the side (we were traveling edgewise to avoid meteorites). Around the dome rose the usual wall of *consulium*, that marvelously resistant metal discovered by Esfon in 10001, to protect the relatively fragile inner structure; to shield, also, the mechanical tentacles. There was little real need of piloting, with the automatic course plotter and steersman working. I looked at the artificial globe of the heavens, seeing on its surface a reflection of all that passed around us. Even as I watched, the surface changed and a small body flashed by, soon to be lost in the distance. Suddenly I saw a familiar bright flash. A muffled clang followed, as a portion of the globe went dark for a moment. A tiny meteorite, not fully deflected by the repulsion tubes, had skidded off the wedge-shaped edge of the disc. The ship performed marvelously; and, as I compared it with the uncertain skyrockets in which my ancestors left the earth for Venus, I wondered at their courage. To me that feat seemed greater than their later journey, in the first Goznac discs, to our present home.

Three weeks brought us within the attraction of the earth. The sun blazed in the sky. I could feel the sensation of weight as we slowed down. We intended to remain above the globe for some time, in order to make a careful examination of the surface. Seen through the electro-telescope the earth was indeed a sorry sight. There was no green thing left on its surface. The insects had killed themselves, worked their own destruction, when they stripped the globe of its vegetation—of the green plants, the only food-producing and air-purifying life upon the earth. What scenes must have been enacted when those huge desperate insects with terrible hunger fell upon one another after all other food was gone! The earth seemed to me but a vast grave.

I observed the cities. Here was our real interest. New York and Paris, the last outposts of man on earth, were best preserved. In the silent streets of the first, as we hovered about it, I saw the Woolworth Building, the tallest skyscraper remaining. Several thousand miles away was the Eiffel Tower in Paris. In these two structures our objective lay.

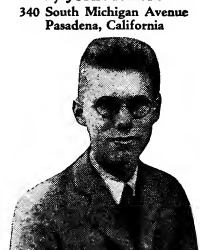
After much labor, carried on with the greatest precautions to prevent damage, we ripped the structures from their bases. We were ready to take them where they would serve as imperishable monuments of the days which our race spent on the earth. It would have taken months to build rigid supports for carrying them, but, thanks to the almost human metal arms of our ships, we could take them into space immediately. Making a last inspection of the supporting tentacles on the Woolworth Building, I gave the word. The building was lifted from its severed foundations, supported on a rough cast *consulium* slab held by a tentacle. Cracks appeared in the facing, but that was unavoidable; and I was justified in my confidence that the steel frame would stand the strain. In the meantime Staner, my assistant, had raised the Eiffel Tower; and we started on our long return journey.

As soon as we had the building far enough from the pull of the earth to permit a great acceleration, my curiosity got the best of me. I donned a space suit of *consulium* air-tight and heat-tight armor, and left the disc to inspect the Woolworth Building and its strange contents. As I entered, I thrilled at the thought that here humanity had made a last stand; here it was too, that the survivors of the Great Menace had planned to leave their home forever. Curiously, I wandered about for hours. In one room I stooped over a desk where counsel over humanity's very existence might have been held! I felt a shock.

Later—how long later I do not know—I awoke. I was dazed, lying in a corner of the room in the tower. The space suit was bent, and I could not move even a leg. The room was littered with a confusion of objects. What had happened?

I crawled painfully to a window, getting there only because of the lack of weight. No discs were visible, no supporting tentacles. The lower part of the building was gone! I was alone in space, adrift in a tiny world of my own! A meteorite had carried away the tower as

Second Prize
$75.00
awarded to
"The Relics from the Earth"
By JOHN PIERCE
340 South Michigan Avenue
Pasadena, California



John Pierce is a student at the California Institute of Technology and his chief hobby is gliding. He is the winner of several prizes in glider meets and was one of the authors of "How to Build and Fly Gliders," published recently by the Popular Book Corporation.

IN awarding the second prize, as well as in our choice of the first, we were guided not alone by the explanation of the science features of the cover, but also by the story or fiction interest.

Mr. Pierce believed that the cover demanded a plausible and interesting, if not exciting, adventure. Where so many of the offerings stumbled about in the attempt of the writer to explain just why the Woolworth Building and the Eiffel Tower should have been selected to be carried into interplanetary space, Mr. Pierce offered us a very convincing reason.

This story has an excellent beginning, an ascending series of adventures and then a very dramatic climax—which after all are the essentials of a good story. The science, furthermore, is adequate.

the disc sped on unknowing! Had they seen my plight? Would Staner realize my fate while there was still a remote chance of his finding me in the vast expanse of space? Was I doomed to die? Such thoughts passed through my mind. I thought of the others, safe in the discs, and envied them. I thought at last of the equipment on my space suit, which provided air for me to breathe in airless space. The supply would last only a few hours. If they did not find me—would I die gasping vainly for a last breath? Would I tear open my suit and perish of the cold airlessness of space rather than hang on until strangulation throttled me? In any event, my body would go whirling through space to its tomb, some day to strike a dead planet—some day, with the irony of fate, to reach Neptune, and make for it an eternal satellite.

I looked from the window again. I saw a dot in the distance, rapidly growing larger. The disc! The men had realized my predicament. Surely I was saved!

The disc grew larger—slowly took form. They neared! I could see the tentacles extended. They waved at me. I waved back, knowing that I was observed through the electro-telescope. All the tentacles were extended. Why all? One would have served to hold this small world of mine. The disc drew alongside of the tower. It entwined the tower in a perfect maze of tentacles. Why that precaution? My brain raced. As the power was applied I had a terrible feeling of weight and pressure.

At last I understood the awful truth. My fragment of the building was falling toward some body, gripped by its field of gravitation. The disc was trying to escape, to drag me with it! With enormous effort I turned over. My head lay a foot from a window. Painfully, I reached the window. Resting my face on the frame, I looked out. Below me I saw the immense grayish bulk of the body. Mars! I watched it, fascinated. Minutes passed. Mars rushed toward me! I glanced at the disc. It could not escape. I saw a flash. It was the powerful auxiliary radium rockets. Staner thought to escape by means of the force of their recoil. A feeling of numbness crept over me. The acceleration was too great. What of my friends in the disc? Were they, too—

I awoke on the disc, three weeks later. The fever had gone. Staner was bending over me. Behind him stood the crew. Out of the window I could see the other disc carrying the two buildings. There was a gentle shock as the power went on for a descent. The men lifted me, and I could see the landscape of Triton. We were safe, and the expedition was a success!

THE END.

The Manuscript . . Found in the DESERT

By FRANK J. BRUECKEL, Jr.

IT happened on the third of April. A torrid sun beat down upon the tawny desert, as my horse jogged dejectedly over the hot sand. Our trail had been a long, hot one; and when I spied a group of low, sand-worn cliffs of red and purple, I breathed a sigh of relief, for it seemed likely that I would find a spring at the foot of the mesa that lay in our path.

Mid-afternoon had passed when, at last, I halted in the shadow of the mesa, before the yawning mouth of a cavern. With the intention of quartering my horse in the coolness of the cave, I advanced within its yawning portal. As I entered, I saw a streak of brilliant white light that emerged from the center of the cliff through a right turn.

I halted, thunderstruck. Before me was a commodious natural chamber, roughly hemispherical, thirty feet across and perhaps eighteen feet high. Suspended from vacuum cups, attached to the dome, was a crystal globe, from which poured that flood of cold, brilliant radiance. At the further side of the room stood a small metal table beside a strange instrument. This latter was composed of a plate of minute crystal globules, behind which stretched a mass of almost invisible strands of wire. These ran into a sort of mast, three feet high and six inches in diameter, crowned with a spherical mass of small wire squares—thousands upon thousands of them.

Under the plate of little globules was a black panel, bearing switches and dials like a radio set, behind which I glimpsed an assemblage of instruments whose purposes were not hard to guess at, though their appearance was unfamiliar. I saw eight crystal globes, each three inches in diameter, which evidently took the place of the familiar radio tubes; two sets of four-inch discs that were apparently condensers of some sort; rheostats, magnets, and batteries.

But what riveted my astounded attention was the being who stood before this instrument. As I halted in the doorway, he spun around and faced me, attracted by the sound of my footsteps. In stature his body was considerably under that of one of our race, measuring some three and one-half feet from shoulder to sole. But above this, on a short neck, was balanced—I cannot employ any other term—a great, globular head fully eighteen inches in diameter! In this head there were set two round *purple eyes*, a sharp, acquisitive nose, and a thin-lipped, firm mouth. The tiny ears were oval. But most astonishing yet was the color of his skin—his face and hands were *blue!*

Barely had the creature glimpsed me when one hand shot to a brown cylinder reposing in his belt, and eased to jerk it from its place; but the instrument stuck for a moment. In that second I realized that I was a dead man were he to draw that strange weapon. My hand dropped to my revolver and, just as that deadly brown tube came clear of the creature's metal belt, the bark of my gun awakened the echoes of that hidden chamber.

The metal tube clattered to the floor as, with two small round holes in the center of his forehead, the blue-skinned being crumpled lifeless to the ground. From the wounds poured a deep purple liquid.

For a moment I stared down, stunned, at the body at my feet. My mind was a chaos of questions. Who—what was this creature? I strode across the chamber and inspected the strange mechanism that I have alluded to. When I thought I was passably familiar with its operation, I pressed a switch. Nothing happened. Emboldened, I whirled a dial. Suddenly a picture flashed upon the screen of tiny globes. I saw that each globule was a tiny light-bulb, having a strand of platinum wire running from it to the mast, climbing the latter, and finally ending in a tiny aerial, not more than an inch square.

I seemed to be looking upon an expanse of dark star-powdered sky, with—the earth?—near the lower right-hand corner of the disc. Just beyond shone the golden crescent of the moon.

But it was the object in the immediate foreground that aroused my consternation. For I stared at a great circular disc of metal that rotated slowly in the eternal silence of space! In its carmine rim were set several dozen circular hatchways, in groups of four each. Within this was an area of yellow metal; then, at the very core of the disc, was a more massive structure, raised considerably above the level of the surrounding disc. Out of a pit in the center of this rose a rod of brown metal like that

Third Prize $50.00

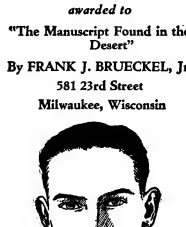
awarded to

"The Manuscript Found in the Desert"

By FRANK J. BRUECKEL, Jr.

581 23rd Street

Milwaukee, Wisconsin



Mr. Brueckel's education has been self-obtained through hard study and a variety of experiences. His hobby is astronomy and his principal occupation is the writing of science fiction.

of the tube beside the dead man. Attached to it and rotating rapidly upon it were two similar tubes of greater proportions, from which shot beams of pale green light. At once I saw their purpose, for countless meteors were constantly shooting toward the disc, only to vanish into thin white vapor as they were struck by those rotating beams of green radiance.

Since the beams could be seen side-on, I assumed that they were composed of corpuscles rather than ether-undulations. On the outside of this central structure were twelve protuberances; from four of these extended long, flexible telescopic tubes of the brown metal, and I perceived that this substance alone was immune to the green meteor-destroying corpuscle beams.

And those four metallic arms—Mother of Mercy! could it be true? They were entwined about a great edifice which from countless pictures and photographs *I recognized as the famous Woolworth Building!* I gasped in horror.

In the distence swam another great disc; and this also had in its grasp a mighty structure, which I recognized as the Eiffel Tower of Paris.

Suddenly something went wrong with the nearer disc. It seemed to sway; I saw the four metal arms disentangle themselves from their prey and move back into their places, while their released captive still floated motionless before the titanic disc.

Of a sudden the scene changed, and I was looking into a small circular room filled with strange machines. Half a dozen large-headed blue men lay stretched on the floor in death, while among them stalked, automatic pistol in hand, a man—a man of our own beloved earth! Instantly I understood. He had been in the Woolworth Building when it was stolen. Somehow he had gained entry to the great disc. Here he had slain the crew and released the great structure from its immense captor. Once he turned in my direction —I saw a strong, determined face, the light of battle in his flashing eyes.

Again the picture changed, so that I had my original point of vantage, which I presumed to be on a third great disc. Suddenly the meteor-destroying tubes on the nearer disc changed their angle so that their beams shot in diametrically opposite directions, away from each other. The distant disc clutching the Eiffel Tower had drawn close; I saw one of the green rays slash like a mighty sword toward it, and tower and ether-ship were at once transmuted to an impalpable powder!

Then the green ray swept around toward me, draping a green veil over the picture. The disc in my field of view gave a frantic leap; I saw it crash into the towering mass of the Woolworth Building; and then a brilliant blaze of green blotted out that tragic sight!

Simultaneously an enormous spark leaped up from some part of the instrument before me; a deafening crash reverberated through the chamber in which I stood. Then I heard a low rumbling from the mesa growing ever louder.

Landslide!

How I ever got out of that cave is a mystery to me. I plunged and battered my way through a hell of choking dust and tumbling rocks. Then, with a ringing boom, something struck my head, and I fell forward into oblivion.

It was night when I came to, and found myself pinned under a mass of shale and rocks. With infinite labor I struggled free. After I had rested I crawled away from the mesa, searching for water. I have been here for days. I am doomed, but reconciled to it.

For the past hour, since I realized this, I have been writing down this terrible experience of mine. The landslide I believe to have been caused by the explosion that shattered the instrument I had employed; and that explosion was produced, I am sure, by some strange effect of wireless power that was set up in the transmitting instrument in the third disc. The disaster was caused when it was struck by the green corpuscle-beam from the ship that had stolen the Woolworth Building.

Soon I will join the nameless hero of earth who, single-handed, destroyed that great fleet from space, and who sacrificed his life in the act.

THE END

[MR. Brueckel's story is out of the ordinary, because it pictures strange people and strange events. It has an atmosphere which makes the incidents pictured convincing.

Mr. Brueckel is an excellent writer and he knows how to convey his effects. While his story is not as original as the first and second prize winners, it shows independent thinking and a very interesting development of events.

We congratulate Mr. Brueckel on the excellence of his story.]

RAIDERS FROM SPACE

Fourth Prize $25.00

Awarded to

HAROLD A. LOWER
1032 Pennsylvania Avenue
San Diego, California

Harold A. Lower

By
HAROLD A. LOWER

Mr. Lower who is 35 years old is an electrical engineer by profession and by avocation a telescope maker. His hobbies are archery, astronomy and science fiction.

GREGORY frowned at the elaborate new television receiver which had been installed "on trial" that morning by an enterprising young salesman. Mrs. Gregory placed a hand pleadingly on his shoulder:

"But it's only twenty-five hundred, George, and we can trade in the old one for seventy-fifty."

"It's not worth that much," grumbled Gregory: "The programs have been commercialized until all one can pick up anymore are stock market reports, department-store style shows and, once in a while, a football game. I will make you a proposition, Marian. If you can pick up a really interesting program, I'll pay for the machine; but, if you don't get something better than the usual bunk that's being broadcast nowadays, back it goes in the morning."

"That's a bet, George," smiled Mrs. Gregory: "I just know I can pick up a good program with this set."

As Mrs. Gregory slowly turned the dials, flashes of light passed rapidly over the screen, and a series of squawks and howls came from the loudspeaker. Gregory snorted disdainfully. Suddenly the flashes of light gave place to a picture, and the squalls from the loud speaker changed to a resonant baritone.

The view on the screen was a strange one. Two enormous machines seemed to be floating in space, carrying with them the Woolworth Building and the Eiffel Tower. In the distance the Moon could be seen; and also a portion of a globe that appeared to be the Earth, although it was so distant that only general features, such as the continents, could be distinguished. So startling and unexpected was the scene, that for some time the voice from the loud speaker went unheeded. Then curiosity turned the Gregorys' attention to the announcer.

". . . undoubtedly the most terrible danger that has ever threatened humanity," boomed the voice: "The cities of New York and Paris have been completely destroyed by the raiders from space. Planes and anti-aircraft

batteries were absolutely helpless against the invaders. The terrible green beams instantly slew all living things with which they came in contact. It is not known as yet how many have lost their lives; but the casualties must be enormous."

Gregory and his wife stared at each other, their faces suddenly pale. Their son was employed in a brokerage house in New York City.

"Steady, Marian. Don't despair. Tom may have escaped. This is Saturday, you know, and he would be starting home early."

Gregory tried to sound hopeful, but the pallor of his face belied his words.

Mrs. Gregory sank weakly into a chair.

"Oh, he is killed! I know he is killed! Oh! My son! My son!" she sobbed.

Gregory tried as best he could to comfort his wife; but his own fears were riding him, as the Old Man of the Sea rode Sinbad.

"Hush, Marian. Listen! Maybe it is not so bad. He did not say just when the attack occurred. If it happened just now, our Tom is probably on his way home, safe and sound."

As that ray of hope broke through her despair, Mrs. Gregory raised her tear-dimmed eyes to the television screen, and again gave heed to the voice from the loud speaker. The scene had changed but little in the interim. Perhaps the Moon was a little larger; certainly the Earth appeared smaller and more distant. The flat, disc-like space ships, with long tentacles writhing and twisting about their prey, resembled strange beasts out of a prehistoric past, rather than creations of intelligent beings. The lighted ports seemed like eyes, and produced an inexpressible sense of malevolence, which the horrifying news that they had just heard served only to intensify.

". . . London, Berlin and Moscow," continued the voice from the loud speaker: "In each case, for some unknown reason, the raiders carried away the highest structure in the city. The radio-controlled rockets which were dispatched in pursuit of the other raiders have evidently been destroyed; as the television screens energized by them showed brilliant flashes, and then went out of action. The rocket which transmits the picture, that you are now watching, is remaining at a safe distance from the enemy. It is hoped that by means of this rocket it can be determined whether the raiders are returning to their native planet, or if they have established a base on the Moon. If the latter is the case, another attack may be expected at any time; and immediate evacuation of all large cities will be necessary. The public is assured, however, that ample warning will be given of any future attacks, and every one is urged to remain at home, and not to give away to panic."

As the voice ceased, the view on the screen vanished. An instant later another scene appeared. This was apparently the ruins of a large city as seen from an airplane. Although more or less obscured by clouds of smoke from burning buildings, the city was easily recognizable. The tall buildings, even though many were in ruins—the great bridges, twisted and wrecked though they were, stamped the scene unmistakably as New York.

The Gregorys gave a simultaneous gasp of horror, then leaned forward and peered intently at the picture. Through the billowing smoke they tried to identify the Wall Street office building where Tom Gregory was employed. For a few moments the smoke baffled them; then the sable cloud was rent by the wind and the financial district disclosed. It was almost unrecognizable. Buildings were shattered, streets choked with debris. Even the strongly-built Sub-Treasury was now but a mound of riven stone. No living thing could be seen.

Again the voice from the loud speaker reached their horror-numbed brains.

"You are now witnessing the devastation created by the enemy in the great city of New York. The loss of life here is appalling. Many who escaped the raider's deadly green beams were killed by falling walls. The destruction of the bridges was responsible for the death of thousands more, as the terrified mobs trampled one another in a desperate attempt to escape from the stricken city."

The pitiless voice went on, describing horror after horror, but the Gregorys no longer listened. Mrs. Gregory had slid quietly to the floor in a faint; and, as he lifted her up, her husband's mind was too deadened by the disaster to register the words that still beat against his ears.

"Against such an enemy as this," the voice continued, "humanity must present a united front. All differences, racial or national, must be forgotten. The nations of the Earth must stand together in a common cause, one for all, and all for one. Divided, mankind will perish from the Earth. United, we *can* win, and I feel sure we will win."

Mrs. Gregory, revived, was weeping at the table. As the voice ceased, the door opened, and Tom Gregory entered.

"Hello, Dad! I see Mom has talked you into getting a new set. Didn't think you would hold out long," called Tom, with a cheerful grin. But as his eyes, momentarily dazzled by the bright sunlight, became adjusted to the dimmer light of the room, his grin faded.

"What is the matter, Dad? Why all the weeps, Mom?"

The next instant his mother's arms were about him, and his father was squeezing his hand as though he never intended to let go.

"My boy! My boy! I'm so glad you are safe," and Mrs. Gregory smiled tremulously at him through her tears.

"Well, for gosh sakes, folks! What is it all about? You act as though I had just returned from the dead," Tom said, bewildered.

"That is exactly the way we feel, Tom," said Gregory, gravely: "We were afraid you had been caught in the raid on New York. We have been looking at the ruins, and it is awful. You must have got out just in time."

"What raid are you talking about, Dad? There was nothing wrong when I left on the twelve-twenty." Tom was frankly puzzled.

"We have been getting the reports over the radio television. Come, see for yourself," and Gregory led his son over to the new set.

Tom gasped as he recognized the ruined, burning city, but before he had time to note details, the scene vanished.

For a moment the screen was blank, then a charming young lady smiled forth from the instrument. As her lips moved, a pleasing voice came from the loud speaker.

"Now, friends," said the melodious voice, "I am sure you have been thrilled by the scenes you have just witnessed, and will want to see the rest of the wonderful German picture, *Raiders from Space*. It opens tomorrow at the Splendid, and I advise you to come early, as these scientific films are always popular, and unless you are on time you may not get a seat."

"Well, I'll be hanged!" said Gregory.

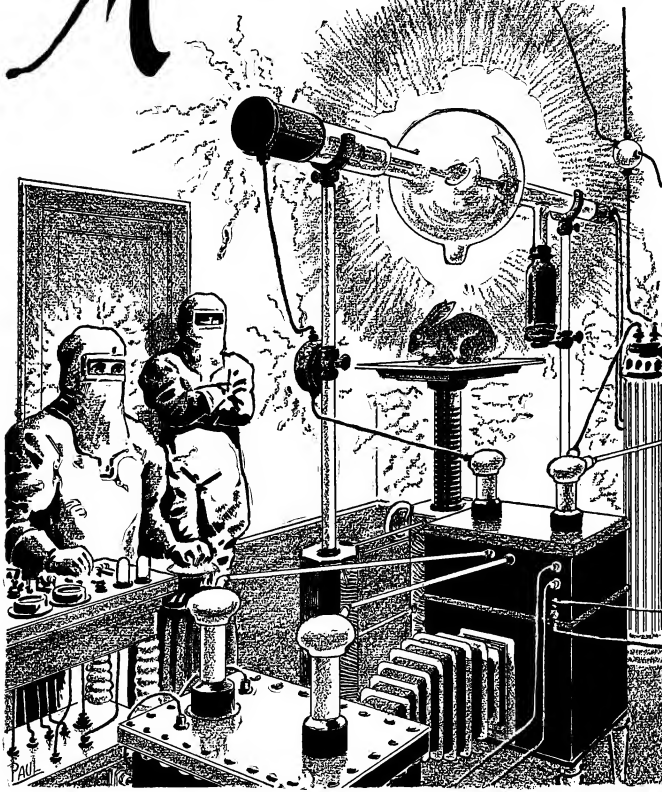
THE END

ONE of the most remarkable things about the short stories of O. Henry is his surprise endings. You learn from him that we must not be deceived too much by the appearance of things, for they may not, in reality, be what they seem.

Mr. Lower, like Mr. Tanner, was not at all deceived. Both determined to give their independent interpretations to the cover. Mr. Lower, while working up a most excellent story, was determined that it should be unusual and unusual it was. For his originality alone, his story deserved consideration, and that combined with the other excellent features of it, led to his being awarded the fourth prize.

The Mystery Metal

By H. James & Maurice James



(Illustration by Paul)

A weird light projected from the tube and seemed to flow through the room. But, when it struck the silvery-covered wall, it seemed to rebound. Everything in the room was undergoing a change.

IT was not yet daylight when I mounted the old stone stair-case, fouled by the dust and smoke of the city, to Dr. Dan Lester's private laboratory. The Metropolis, which never sleeps, was already a-bustle. Though the day's rush had not yet begun, people were already going to and fro; street cars were clanging and trucks and automobiles roaring by; and dirty, tattered newsboys were calling out their wares in a husky voice to the passers-by.

Only one light could be seen in my friend's dwelling—the one in his private study. Evidently he was the only one awake in the place. Without ringing, I entered—Dr. Lester's house is always open to his intimate friends and besides, when he is at work at some problem of unusual moment, he is too unaware of what is going on around him to be disturbed by doorbells. Without further ado, I made my way to the laboratory, where my friend greeted me.

MAURICE JAMES

T. HOWARD JAMES

"Come in," he said. "Won't you sit down?"

A Mysterious Crime

"WHAT'S it all about, Dan?" I asked, as I seated myself.

There was no answer. Dr. Lester was obviously worried. Such an expression I had never seen on his face before! He seemed to have aged several years overnight. His eyes had lost their usual sparkle; his face was pale. There was something radically wrong; it was not study over an ordinary problem that had put him in this condition. I knew him too well to question him, so I sat there for a moment, regarding him, waiting for him to speak.

He finally broke the silence.

"Get me a copy of the morning paper, will you, Jack?"

I descended to the street and with difficulty made my way to a newsboy. The morning papers were going fast. Without glancing at it, I returned to the laboratory, and, as I threw it on my friend's desk, the bold, staring headlines proclaimed: "MURDER AND BANK ROBBERY BAFFLES POLICE."

I read on:

"New York is in the midst of one of the most amazing mysteries on record. The police force and private detectives are completely baffled. Some time last evening, in some mysterious way, the Interstate Bank and Trust Company was entered, its entire supply of gold taken, and replaced by a mysterious metal which cannot be identified, and Thomas Lester, President of the bank, killed—!"

"Good God, Dan, your brother—!"

"Yes." Dan's voice broke.

"That's why I called you over—to help me." His fist clinched. "I must solve the mystery. That metal—."

He picked up a curious looking specimen of metal from his desk that had previously escaped my notice. In outward appearance it resembled bronze; but no, it was not bronze; it had an undescribable hue that gave it, I might say, a sinister appearance.

"What is it?"

"I wish I knew," said Dan. "It is the mysterious metal from my brother's bank. More I cannot tell. That is the mystery which I am trying to solve. What it is and how it got there—." He paused.

"But how was your brother killed?"

"That, too, is a mystery," he answered, solemnly. "He was found dead—no sign whatever of violence. Heart-failure—that is the only reasonable hypothesis—But Tom always had a strong heart. It is all mysterious, I tell you, Jack."

"Have you any idea what happened to the gold, and how this bronze, or whatever it is, got there?"

"None. Kilblaine, the night watchman, was in the outer room all night; and he heard nothing. It was he who found Tom dead. There was no sign of anyone having entered, and furthermore—hang it, Jack, do you realize that it would have taken a truck to transport this curious metal to the bank and take the gold away?"

"But you have no theory at all?"

Dr. Lester hesitated. "A wild one," he said at last. "The weight of the bronze was exactly equal to the weight of the gold. *In some*

SCIENTISTS are agreed upon the fact that no element is stable in this world. Everything is changing, more or less gradually, from one form into another.

Radium, the most precious of all metals, in a period of about 2500 years, turns into common lead, giving out, during this time, an enormous amount of energy.

Sooner or later, some scientist will find the key to transmute one metal into another, and when that time comes, mankind will burst its age-old fetters and become a super-race. The tremendous amounts of energy let loose during the transmutation, science hopes, can be used to run all of our machinery.

The present story deals with transmutation, but for a strange purpose. It illustrates the power wielded by the scientific brain. We know you will like the story.

way the gold was changed to bronze! But how? And Tom's death—from heart failure? Was it a coincidence?"

The ringing of the doorbell interrupted us. Dr. Lester arose to admit Chief of Police Dennison—a gaunt, rugged character, to whom excitement was usually alien. But I could see signs of worry and perplexity even in Dennison's stoical face. He entered, quite out of breath, flopped in a chair, and demanded abruptly:

"That metal—any interpretation?"

"The mystery is as deep as ever, Chief," said Dr. Lester. "The metal has me stumped—I admit it." This was the first time I had ever known my friend to be stumped on any scientific problem! "At first sight, I'd say it was bronze, but it won't test. Its density is fifteen. That means it's neither gold nor bronze. What is more, its hardness is close to six. That is extraordinary for a metal. There may be a metal that fills that description, but I've never heard of it. And even if there were," he mused, "that wouldn't explain how it got there."

For a moment the three of us sat in silence. Lester was wrapped up in thought; the Chief was fumbling with his hat; and I sat there, blankly, I suppose, looking from one to the other. A moment of complete mental vacuum! Then Chief Dennison spoke:

"I had another little talk with Kilblaine, which only deepened the mystery. There was no sign of anyone having entered the bank, he said; and he seems to have spoken the truth. Besides, there are always people passing on the street outside, even in the dead of night, and nobody saw anything suspicious." He stopped; then suddenly his face lit up, but painfully. "Could it be an inside job—Kilblaine—?"

"You forget the bronze—the metal," coolly interposed Dr. Lester.

"Yes, that's true," said Dennison in disappointment. "Still a mystery. The whole thing's impossible; yet it happened. And your brother's death—The doctors pronounced it heart failure."

The City Baffled

WHEN Chief Dennison left Dr. Lester's home, he was visibly disappointed; he had pinned complete faith in the scientist's ability to solve the mystery in short order. And in the few days that followed, things became extremely critical. The Werner National Bank shared the fate of the Interstate: vast sums of gold disappeared, to be replaced by the same mysterious bronze-like metal left in the Interstate. But in this case no deaths occurred. And two days later came the climax. The Hollingsworth National Bank became the third victim. At ten A.M. the cashier had entered the vaults, and everything was all right; fifteen minutes later he re-entered: *The gold was gone, and the metal of mystery had replaced it!*

And at seven minutes after ten, three men who were standing on the north side of the bank, and directly north of the vaults, fell dead in their tracks. Examination revealed that their deaths could be accountable only by heart failure.

The city was in a panic. The masses are strangely apathetic to scientific problems, except when they touch that which is so dear to them, their pocketbook; but this new menace struck them as forcibly as anything could. A financial panic was threatened. People rushed to the banks to withdraw their funds; riots occurred which needed the police to prevent street bloodshed. Great excitement prevailed in Wall Street. And everyone was taking the problem into hand and trying to solve it: amateur scientists, suggesting extravagant hypotheses; detectives, trying in vain to run down the culprits; religious fanatics, attributing these disasters to God's wrath toward a mercenary world. The police were desperate; Chief Dennison had threatened to fire everyone on the force if the mystery was not cleared up in a week. My hopes that the culprit would be found, had almost disappeared when I finally received a note from Dr. Lester to come over to his laboratory at once.

Chief Dennison was there when I arrived. He was excited and speaking incoherently. Perspiration streamed down his ruddy cheeks. His usual calm had left him completely; he was as overcome with excitement as a six-year old child at a fair. The strain of the last few days was telling on him, and on Dr. Lester too; but the latter now seemed unusually calm—more than he had been since the disaster of the Interstate Bank and the death of his brother.

"This mystery *must* be solved!" Dennison was almost shouting. "The city is wild. The people are threatening—"

"It is solved," said the other, complacently.

"It is—what?" Dennison gasped.

"Yes, it is solved; the mystery of the gold, that is; and the rest will not be hard. If my deductions are correct, you will find the culprit at 332 Grosvenor Place; but be careful—" he warned as Dennison bolted toward the door.

"I'll get him now," shouted Dennison, almost in a fury.

"Fool; do you want to be killed—throw your life away, for nothing?" said Dr. Lester, catching the Chief by the arm. "You, of the police force, can cope with ordinary criminals well enough; but when it comes to a scientific criminal—one who uses instruments powerful enough to change gold to bronze—" Dennison winced— "that is a different matter. And do you think that a man who uses such machines for such diabolical works would hesitate to use them in self defense?"

"But what's to be done about it?" the Chief gasped. "I trust your scientific knowledge implicitly, Lester, but, for Heaven's sake, do something—and do it quick."

"Meet me at 332 Grosvenor Place in an hour;

but disguise yourself. No, Jack, you stay with me" he added as I started to leave.

For a few minutes after the Chief had gone, Dr. Lester was engrossed with some papers on the desk before him; then, with a sigh of satisfaction, he rose and beckoned to me to follow. My friend threw open a small door, partly concealed, and together we went through a dark, narrow corridor, through which I had never been before. In fact, often as I had been in this house, I never knew that such a passage existed. Darkness loomed ahead; we had come to the end of the corridor. Dr. Lester threw on a light; a door appeared. Opening it, we entered a room. A strange sight greeted my eyes.

It was evidently a secret laboratory. By all appearances, it had been hastily remade. Common instruments were strewn about in disorder; vials, flasks, balances, other chemical and physical apparatus; the metal parts of them had taken on a peculiar hue. The walls, doors, and even the windows, were completely covered with an odd looking, silvery colored metal. But the most striking feature was a grotesque instrument in the middle of the room. Two tubes, mammoth in proportion to the rest of the apparatus, were suspended between lead spires at the top of the cabinet, beside which a large transformer rested. On a cabinet lay a metal tray, directly within the focus of the tubes.

While I stood there, viewing the whole scene in astonishment, Dr. Lester entered a small closet adjoining the room, and after a few seconds came back with two grotesque metal suits, of apparently the same composition as the lining of the walls. One of these he gave to me, the other he put on himself. I was greatly surprised at the lightness of the suit and the freedom of movement it permitted. It was as flexible as cloth.

"You wonder what it's all about?" said my friend, with a triumphant smile.

I admitted that I did.

"Well, watch closely; but stand back out of the range of the tubes, and be careful."

Dr. Lester Explains

HE stepped to the instrument and made several adjustments; then looked the thing over again, to see that all was satisfactory. Producing a gold coin and a live rabbit on a small plate, he placed them on the tray; then, stepping back, he took his place beside the transformer, and closed his hand over the knob of a long switch. I stepped back in astonishment. There was a low whir, then a loud screech, as he threw the switch. A weird light projected from the tubes, and seemed to flow through the room. But when it struck the silvery-colored walls, it seemed to rebound. Everything in the room seemed to undergo a change. Metal fixtures turned white and showered sparks. I looked at Dr. Lester. One would have thought he was a flaming torch. He was completely wrapped in sparks.

My eyes wandered back to the tray in front of the tubes; and as they became accustomed to the light I noticed the rabbit: it had fallen over, stone dead. Just then Dr. Lester threw off the switch, and I ran toward him, all excitement. The dead rabbit was uninjured, externally. And *the gold coin was changed to the mystery metal*—the same bronze colored stuff found in the vaults of the victimized banks!

"That, then, is the solution!" I managed to gasp out when the room had become cleared and I had collected my senses. Still, it seemed to me, the mystery was nearly as deep as ever. What was this mysterious ray? Who had operated it? And how had it been directed on the banks? And what was the author's diabolical purpose? Lester broke in on my thoughts.

"Yes, this is the solution. Do you know what the ray is?"

I admitted my ignorance.

"It is a type of cathode ray, more powerful than any produced before, and used by the hands of a misguided genius. I have, fortunately, duplicated his discovery."

"But how—and why—?"

"Just a minute. Let's get out of here." Dr. Lester was shedding his metal suit, and motioned to me to do likewise. "Come to my study; and I'll show you more."

It took but a moment to retrace our steps through the dark corridor. Re-entering the study, I threw open the windows to the street. How good that fresh air felt; even the dusty air of a busy metropolis! There was little time to enjoy myself, however, for Dr. Lester had already procured some papers from his files, and was calling me to his desk.

"Here," he pointed out, on a map of the city, "is the location of the Interstate Bank and Trust Co. Draw a line through the vaults and the place where Tom was found dead; it runs like this." He made a mark with a ruler. "Then here is the location of the Hollingsworth National. Draw a line straight north—the three men fell dead on the north side, in line with the vault, you know. *The two lines intersect at 332 Grosvenor Place.*"

"It is from there that the fatal rays have been directed! Furthermore," he explained "the fiend must have his instruments on the eighth floor; otherwise it would have affected other persons in the path of the rays. Directed from higher up, they would not have struck the men in front of the Hollingsworth Bank. Directed lower, they would have affected others."

He fumbled with his papers for a moment. "I have a further confirmation of my theory: here it is." He handed me a newspaper clipping several years old. It read, in part:

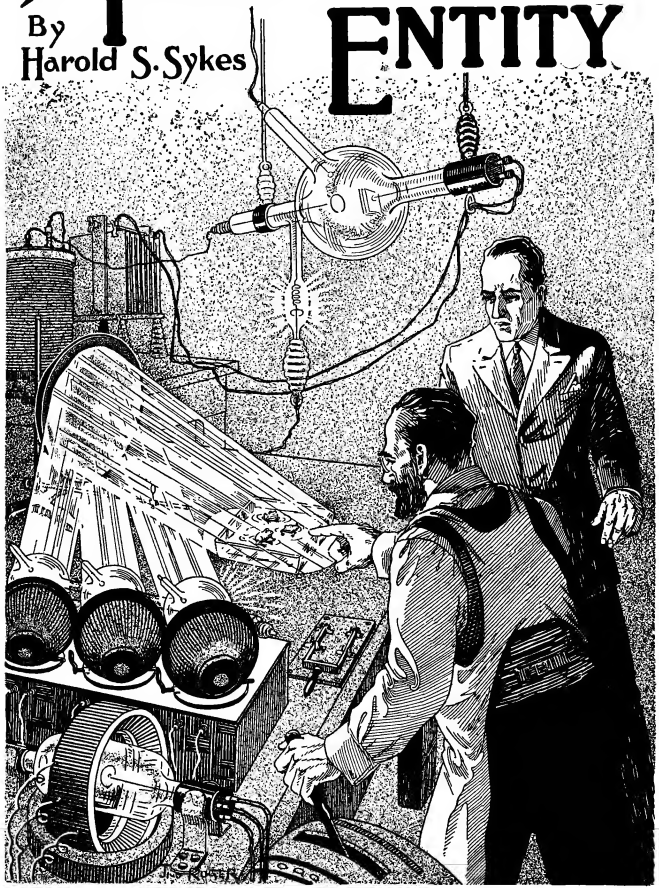
"SCIENTIST ATTEMPTS SUICIDE

"John R. Kay, 332 Grosvenor place, attempted suicide early this morning, by poisoning; but friends discovered his plight just in time to save his life.

(*Continued on Page* 932)

The INSATIABLE ENTITY

By Harold S. Sykes



(Illustration by Ruger)

Within a few seconds as I watched, the largest tadpole of the three seemed to stretch before my eyes into a tiny frog. And the same happened with the other two. Then the doctor reached for the switch.

"DID you ever try to tune a short-wave radio transmitter on a one-meter wavelength, or less?" My friend Doctor McInnis was speaking, as we turned from an excellent dinner to his comfortable living room, and seated ourselves in deep leather chairs.

"Why yes, I have tried it," I replied, gazing at him: "But, beyond building an experimental one-meter set and losing a couple of tubes, I can't say that the experiment was an entire success. The oscillator would suddenly cease to oscillate and, within about one second, it would turn white-hot, and go the way of all tubes when overloaded—get soft or burn out. I don't think research on such short waves will ever be developed to the point where they are at all practical."

"You are wrong," replied the doctor. Then, after pausing to light a cigar, he continued:

"I have been experimenting lately and have found, not only that a set may be operated on a one-meter wave, but that, with the proper equipment, there is no practical limit below one meter. If there is, I have not found it. In fact, I have gone as far below visible light rays as radio waves are above them. The vibrations are no longer radio or light waves as we know them, but are very interesting, nevertheless."

After delivering this statement, he leaned back in his chair and busily engaged himself in blowing a series of perfectly-formed smoke rings ceilingward. He knew that I would ask for further details—and I did.

"Tell me about it," I demanded: "Have you been able to produce waves so short that they are entirely new to science?"

"Well, yes, I fancy so. Don't think that I have it all worked out yet, for I haven't. But, by checking up on the results I've obtained, I'm beginning to get some new theories on light waves, Millikan rays and their relationship.

"I could demonstrate it better than I can tell you about it. Now—by the way, why don't you stay with me in the laboratory for your vacation, instead of tracking off to the mountains and chasing the fish around, or whatever it is that you do there? You said that your vacation would be in order at about this time. With your knowledge of radio you would make a valuable assistant, and I can promise you some surprises."

"By all means! I should like nothing better. I shall arrange to be here next Monday to go into this thing with you." And there we let the matter rest for the time.

I had seen the doctor's workshop or laboratory a number of times, but was hardly prepared for the elaborate equipment I saw when I reported for duty, bright and early Monday.

"Well, you certainly have gone into this pretty deeply," I said in awe: "I understood you were particularly interested in spectroscopic work."

"I was," he answered, taking off his coat and donning an apron: "Working with the spectroscope led me into byways, so to speak, and so I went to work and added to my meagre fund of knowledge about radio during the past year. I tried out some foolish experiments on short-wave work. I think I have stumbled on something new. It looked like a silly, useless experiment; and, with what I know now, I should never have tried it.

"Here, I'll show you one of the new tricks, and then explain about it afterward." He stepped over to a long table that would have delighted the heart of any dyed-in-the-wool amateur. There were tubes, inductances, choke coils, switches, and some strange contrivances which were to me a deep mystery.

He threw a switch, and I could hear the crescendo whine of a powerful motor-generator set somewhere in the building. Then what appeared to be the filaments of several tubes glowed brightly.

"These are what I call my ultra-ray tubes," he announced, pointing to a row of iridescent glass bulbs. They were, by now, glowing with a deep purple which quickly changed to a violet and then went black and lifeless.

HAROLD S. SYKES

WE human beings residing on our little planet, Earth, are really the result of many thousands of cosmic forces operating on us. Of these forces, we know very little and, therefore, we might say that we are helpless in the face of them. Because those forces have not been unkind we have been able to develop to our present state.

Of the influences that emanate from far-off space, we know most about the Millikan or so-called "cosmic rays." These extremely short waves of energy are very powerful, and, in fact, they are able to penetrate through six feet of solid lead. Of the effect they have on our physiological and mental constitution, we know practically nothing. But it would not seem surprising that some scientist in the future should be able to isolate the rays to such an extent that tests can be made of their effect on bodily organisms such as our own.

Along with the cosmic rays, there may come to us out of space many other radiations of extremely short wavelength of which we know little; and it is extremely possible that some time in the future the nature and power of these rays will be discovered, produced artificially and utilized.

Such is the theme of Mr. Sykes' entertaining and illuminating story.

McInnis then scooped up some little tadpoles from a glass bowl and poured them into a quartz dish. This he placed in front of a quartz hyperbolic reflector, carefully adjusting the dish to what was probably the correct focal length.

"Now stand back to one side, and watch the tadpoles," he said, as he threw in a long-handled switch. For a moment nothing happened; although I seemed to sense the fact that the generator set was laboring under a greatly-increased load. The embryo frogs did not move; though whether stunned or indifferent I could not at first determine. However, I had seen them kicking heartily and swimming around while the dish was being placed; so I knew they had been alive.

Within a few seconds, as I watched, the largest tadpole of the three seemed to stretch before my eyes. Its back legs, which were already partially developed,

actually grew to the perfect limbs of a tiny frog! Though I could not believe my senses, I continued to stare at the animal, as his front legs literally sprouted. Then he became flatter and more frog-like and lost his tail.

I had been so startled, I had failed to notice the other two; but I saw now that they had both become more developed, more like what they would have been within a few days, had nature been allowed to take its course. Then, as the three little creatures seemed to be galvanized to instant action, the doctor hastily reached for the switch and broke the current.

"Too late," he remarked in the most matter-of-fact tone imaginable.

"What's too late? What do you mean?" I asked, trying in vain to regain my composure.

"They are dead. I left the current on an instant too long; but you can see what this wave will do."

Some Wonders

I HAD seen. But, really, had I? I did not know whether to credit my eyesight or not. I must have looked very foolish, for the doctor glanced at my face and broke into a hearty laugh, relieving the tension.

"You don't know why they seemed to be so violently alive and are now dead? It was because they starved to death! Their natural life-cycle was increased by the vibration until their growth out-distanced the amount of energy stored within their bodies. Had I not tried to force them so far, they would have recovered from the ill effects of the wave vibration within a few minutes, and continued to grow naturally.

"I can do other things of that sort; for example I can take a hen's egg that is partly hatched—about a week or eight days—and bring the chick outside the shell within twenty minutes!"

"Why, why—that is almost life—life itself!" I stammered.

"Yes, it is—almost. And that is what we are going to work on. I believe that, with rays properly controlled over a period of time and focused on the proper inert organic matter, we may actually produce a living, breathing animal of some low form from, well—nothing, you might say."

"Why, why, I can't understand it," I said, lamely. "Let me think about it for a while; and maybe I shall be able to get myself to believe what has happened."

"All right, Charlie; let that go for a while now and help me with some work on the larger ultra-ray tubes. I'm going to evacuate them and load the inner shell with an inert gas."

In a smaller room off the main laboratory we worked at the big tubes for the balance of the day.

This was more in my line; for I knew at least something about the ordinary radio tube and understood how to operate a high-vacuum pump. Following his instructions as closely as my dazed senses would allow, we worked on the new apparatus until sundown, forgetting about lunch. We were not recalled to the passage of time until the growing darkness made us realize that we should need the incandescents if we were to continue.

"That's all for today, my boy; we don't need to work ourselves to death on this, for there is much to do yet. Come in the house and we'll see if Bang Wo hasn't some supper ready. Then I shall theorize about this business if you don't mind; it may clear up some points for both of us."

I agreed most heartily. So, after a satisfying dinner, made doubly palatable by the omission of a noon meal, we seated ourselves in the living room, lit cigars, and sat silent for a few minutes.

"It's this way," McInnis began at last: "It is pretty generally conceded that radio waves, light waves, and electricity are all one and the same. For the sake of argument, we shall assume that the ether, from what we know or have been able to prove about it, is some all-pervading thing which occupies all space—even solid substances. It is all over the world and, more than that, it pervades every part of the solar system; even the entire universe, for all we can prove to the contrary.

"Let us go further, and state that the ether can and does transmit vibrations or waves of any length equally well, from the shortest, far below anything we can conceive, to the longest radio waves of thousands of meters.

"Now the theory I have worked out is this: these waves are responsible for all life on our planet today! You saw what one wavelength did when concentrated on the tadpoles this morning, and in just a few seconds—what have these waves done during the untold eons of time since the world was born?"

"Wait a minute," I answered: "You haven't explained that there are any such waves outside your laboratory. What has been producing them for these countless ages you spoke of?" I thought I had floored him and settled back in my chair with a relaxed air of satisfaction.

McInnis smiled at me: "All right, I thought you would try to catch me up there. Suppose the sun has been producing this invisible light, this series of wave impulses, or whatever you care to term it, ever since there has been a solar system. I believe that all the countless millions of stars we know of are throwing off these rays. We know the sun gives off what we term white light, and this same light is made up of an infinite number of wavelengths. An ordinary crystal prism will resolve the colorless light rays into all the colors we know. We are also sure that the infra-red vibrations, too long to register on our optical nerves, are being thrown off by the sun along with these visible ones. Also the ultra-violet, the little fellows which photograph on a negative, are invisible to us. How do we know that this is all there are?

CHAPTER II

The New Wave

"THE human eye will recognize, or respond, to light of approximately one-two thousandth of a millimeter wave length. Now the gap between the short radio waves and the long light waves is not so important or so large as one might suppose. Findings of German scientists and valuable researches of Nichols have closed this gap.

"Now, in the other direction, it is thought that the air, and more especially the ozone in the upper strata, is opaque to the shorter light waves. But we don't know whether that holds good or not. For example, with vacuum apparatus, the rays from a lamp have been traced back to 1/100,000 of a millimeter, and X-rays are one hundred times shorter than these. And finally the rays discovered by Millikan are two thousand times shorter than the better-known X-rays! It is my opinion that at least part of the rays thrown off by the sun are so short that the air does not stop them. You have read of the Millikan rays, that will penetrate six feet of solid lead, haven't you? The wave length I am working on is somewhere in that order—perhaps a little shorter."

"Well?" I inquired feebly.

"And not only that," he continued, "but may not a still different range of vibrations be responsible for terrestrial magnetism? What can you prove to the contrary? The phenomena of an electric current may be plausibly explained in this way also. How do we know the sun isn't

throwing off other waves so short that the vibratory periods of atoms of certain elements are influenced by them?"

He was snowing me under with his avalanche of theories, and I hated to admit it. I needed time to think such things over; and just now my mind was in a daze. So I remained silent and listened; McInnis did not need any questions to keep him going. I could not remember one-tenth of the discourse at the time, but in later conversations I absorbed a part of it; and, though I do not pretend to understand all the theories which he says should be very plain and evident to every one, I now fully believe in some of them. But our later experiments had a great deal to do with that.

THE next few days were spent in building tubes, four times the size of the first the doctor had used. While we were doing this, he explained his system for producing the ultra-frequency waves. As nearly as I am able to remember now, the tubes were built double, that is each had the two grids, two plates and two filaments of an ordinary tube, all in one glass shell.

It seemed that, if the characteristics were of the right values, it was possible to start an ultra-high frequency surge between the two component halves, and by coupling in the center of the wire joining the two plate leads a double frequency, or wave just one-half the length, could be obtained. I thought I understood the principle of heterodyning tubes; but with these double ones I was lost in a maze of theories. McInnis explained several times that it was possible to heterodyne this half-wave with a pair of regular oscillators and so produce a differential frequency, which was amplified and again heterodyned and so on, until the ultra-short vibrations were reached.

One particular wave length was very bothersome and would melt down the tubes instantly. But, by starting with the right value it was possible to skip over this and double the frequency each time until the "life" band was reached. One tube—the second one, as I remember—did run dangerously hot at all times.

"Have you ever gone beyond this 'life' band?" I asked one day as we were testing some new tubes on low power.

"No, not yet, my boy. In fact I have no idea what the shorter vibrations might do. But I shall try them sometime."

Finally, we had our large set completed. With extremely low power we tried it on a single tadpole—one about half developed. I was so excited I could not stand still. We timed ourselves with the apparatus and found that it was necessary to open the switch at the end of fifty seconds, which would be just in time to save the animal.

"That's about what the first machine did on full power; now we have the equipment with which we may do something startling, or I miss my guess." And the doctor rubbed his hands together in satisfaction, and paced up and down the floor. Suddenly he stopped and came back to the table.

"There would be no use in experimenting with a small vertebrate, however. I am sure we would kill the beast within two seconds. Let's skip all that and go to work on some substances that go to make up a living animal. Take the amoeba* for instance; that is simple enough, or should be. We shall produce a living super-amoeba out of the elements found in the natural ones."

A New Test

BUT upon second thought Dr. McInnis decided he was over-reaching himself.

"It's this way," he explained: "an amoeba is not made up of simple elements, but of very complex compounds; and it seems impossible that the beast would grow directly from inert matter, though it should eventually evolve from just that. It would be too slow for a first experiment, entirely too slow." He was always talking of "beasts"—it was strange that an eminent scientist should use such a word indiscriminately, for all animals of whatever nature. I never became accustomed to it, though I am no scientist myself, and never shall be.

"Let us try it this way," he went on: "We shall use medium, or rather high, power on living amoebae and force them very rapidly and see whether we may not get some complex derivatives from their bodies, if they are in the proper solution. They must be in a proper solution in order to obtain nourishment." And so we went to work.

I had no idea what he meant by the proper solution; I thought water was the proper solution for any self-respecting amoeba that ever lived. McInnis, however, mixed up some gelatin and agar-agar in distilled water. He then added various other things until it seemed to me that any animal would be under a fearful handicap, simply trying to exist in the stuff. It was a dirty, sickly-green color when he had finished, with a fetid odor of decaying vegetation, or decomposing flesh. I was unable to decide which.

Nevertheless he went right on in a blithesome manner and secured some of the *Mycetozoa**—think he called them *Didymium difforme*—from a place in Newark and had them sent over by special messenger. We placed a quantity in a small quartz dish and set the reflector so that it would point down on the surface of the liquid at about the center.

"I am going to try half power, as soon as a little of the solution is poured in the dish. Measure out ten cubic centimeters in that beaker and we shall try it."

I measured out the stuff while the tubes were warming up with the filament current. Then, upon his signal, I poured it in. I had barely got my hand out of the way when I heard the new large generator pick up the load. My first thought was for the tubes; for, having lost so many in radio work, I was apprehensive about them. But all except the second seemed to be running cool, so I turned back and looked into the dish.

The mass was darker now and ruffled; just as the surface of a small pond is beaten when the wind whips across it. Within ten seconds, perhaps, there was a frothy scum forming around the edges, which banked up on the sides of the dish, leaving a hollowed inky-black swirl in the center—a maelstrom effect.

The liquid seemed to dwindle, and the froth increased around the edges. Then I heard the switch opened.

"We shall try some of that under a microscope and take a look at the little beasts."

I reached for a glass slide and prepared it with a drop of the mixture. We hurried to the microscope, which was under a good light from a north window, and Dr. McInnis focused the instrument, turning the adjustments back and forth and peering into the eyepiece until I could no longer contain myself.

"Let me see it," I asked finally, and silently he moved back that I might look. I searched the field in growing wonder, and twisted the adjustments, but to no purpose.

"There is nothing there," I exclaimed, as I turned to him.

"Absolutely nothing, except a brownish-green coloring," he answered. That was all that I had seen.

"Wait, the scum, the scum," he cried and rushed back to the apparatus, returning with the dish. He hastily

* A one-celled animal. The simplest form of animal life.

* A class of protozoans occurring on damp surfaces exposed to atmospheric air, and which feed on organic debris.

spread a minute quantity of the froth on a new slide and handed it to me, meanwhile reaching for a simple magnifying glass.

This time I could make out one edge of a bloated, puffy patch, though it appeared to be lifeless. I was trying to remember, from my biology days in school, just what the animals should be like, when McInnis gave a grunt of satisfaction.

"There they are," he said: "The solution dyed them a darker color, but they are at least three times the size of the ordinary animal, and not dividing yet. I am sure they are alive; yes, I can actually see them growing. The rays must have an after-effect on them. Here, you take the glass and I'll try the microscope." He handed me the small lens.

I could see them much more clearly now, and soon verified his statement that they were growing, though it was doubtful whether they still resembled their original forms. I thought they should be flattish, with a distinct center showing within the body. These were like little drops of strawberry jelly, only moving a little at a time, but swelling a great deal; steadily growing larger and more repulsive.

CHAPTER III

The Mass Grows

THE doctor turned away from the instrument, remarking that the one that he had been observing had stopped enlarging.

"Well, come here then," I said: "You won't need a glass to see them now. They are growing rapidly, although some are becoming much larger than the others."

What we thought was froth—the animals thrown up with the solution on the sides—was slipping back into the liquid. We could see the creatures, still increasing in size and, as we watched, they seemed to be fewer in number. This was startling enough in itself: but, when we noticed that the larger ones were absorbing the little fellows, we became speechless. I had always understood that the amoebae reproduce and multiply by division, and live on small animal or vegetable life; but to see them turn cannibals, to form one large one where there were dozens before, was inexplicable.

"Tell me something about these things," I cried: "Don't all amoebae divide by fission when they grow to a certain size, and so produce others?"

"No, these beasts are slightly different, or should be. They are the only particular order to develop spores, which are carried in the air, to settle in water, burst, and reproduce.

"Or, at least, they should be," he added.

"Well," I replied, "perhaps they sent us the wrong sort of *Mycetozoa*, or whatever you call them; but they are devilishly interesting nevertheless."

And we watched with magnifying glasses at first, and then with naked eyes, the mass of growing plasmodium in the little dish. It was decidedly like a creature struggling for its very life—heaving, bubbling, and at times quivering like so much jelly. The doctor in his excitement kept repeating that the coloring was wrong, all wrong, and I have a hazy recollection of answering a number of times that perhaps the liquid mess he insisted on mixing for the creatures might have something to do with it. However, the droplets so like strawberry jam were within a few minutes fused or merged into one lighter, roundish, undulating mass. Its outer part was a pale yellow and the dots clotted in the center, dimly seen as the mass moved and grew under the powerful laboratory incandescents.

Perhaps it was an hour later, although time slipped by unnoticed, when we awoke to the fact that the thing, whatever it might be, no longer grew. The dish was dry of the solution, but the protoplasmic body, now the size of an English walnut, still lived; for it would alternately send out and retract irregular "processes", as McInnis termed them. I called them bulges, at the time, but believe they are known as *amoeboid pseudopodia*—or, perhaps, "false feet" would be a name more easily understood.

THE dome-shaped thing finally grew quiescent.

"We shall put it in a bath of my solution, so that it may take up more nourishment if it likes," he said. Pouring perhaps a pint of his sickening mixture into a large porcelain-lined utensil, he picked up the dish and held it at an angle over the liquid. Seeming to sense the food below it, the huge plasmodium sent out a tentative, exploratory feeler, bulging to a knob on the low side; then quickening, it merged within the enlarging bud, and so moved to the edge of the dish, where it paused for a moment.

Over it went, with a nauseating "plop", and splash of solution on the side walls. I noticed a filthy green slime remaining on the little saucer the doctor held.

Sending out exploring fingers, the mass slowly flattened until it was scarcely above the bath. We could see the inner dots or nuclei merging and separating, merging and separating, and then it grew.

Before our eyes it swelled and swelled, like a motion picture of a growing melon or tomato. At first I was amazed, then I felt faint and dizzy, leaning over the low table and peering down on the malignant growth. It grew more repulsive and sickening every minute, but McInnis evidently did not share my feelings; for he set about mixing up more of the same solution.

"Let us bottle this thing up and leave it until tomorrow," I suggested: "It's getting positively disgusting." And I walked away to a window and stood looking out at the peaceful moonlit scene spread before me. Here was life in the making, I reflected. Or perhaps, life in the raw would be more appropriate. Finally unable to resist the fascination of it, I turned to watch McInnis again.

"I should like to see what its limit is," he replied. He reached for a carboy of distilled water, and poured it into a long, deep enamelled sink running along the far side of the room. So I stayed and watched him, as there was little else to do. I would not cast my eyes on the plasmodium now; it was revolting. And moreover, I'll admit, I was afraid of it now.

Finally he had about five gallons of solution in the sink, held by the rubber drain plug, and he started around the center table to the "beast". Then I saw him stop with a silly, amazed expression, and gaze pop-eyed at something. As I turned, I knew instinctively what it was, and I had a nasty sense of forboding, of some dire experience in store for us.

Above the walls of the kettle I saw a heaving, uneasy red-brown dome of animal; the creature or creatures we had started. The pot was full and, like a newly-risen pan of dough, the monster was lopping over the sides. Perhaps it was trying to get out, I thought, as it quivered and pulsated with an ever-changing outline. It revolted me more, perhaps, than anything in my life, and I have been a witness to some mighty nasty sights. But I could not, it seemed, look away; the thing held me spellbound.

Growing

"HELP me with the pan and we'll dump the beast in the sink," I heard a dim voice, and realized that McInnis was talking to me.

"Are you mad? Don't you know it is a thousand times too big already? I was ready to help you as far as you liked, but that thing—it—it's more than I can stand." And I finally drew my eyes away, and looked at him.

"I shall move it then, if you feel that way about it," he replied; and, suiting the action to the word, he clasped the sides of the pan in his hands and pulled it to the edge of the table where he could get his fingers under it. I noticed that he was very careful to keep his arms well apart at the elbows lest the filthy thing might touch him. It did reach out a cautious bulging pseudopodium, but quickly drew back within itself before coming in contact with him. Had it actually done so, I am sure I should have screamed.

Mechanically, I followed the doctor across the big room, only stopping when I saw him hold the kettle over the sink and tip it steeply to the side. I fully expected the pulsating organism to pour, like so much oil, but it seemed for a moment to be trying to stay within the vessel. As tar from a leaky barrel would stop in mid-air on a cold day, it hesitated, sending out an exploratory finger, stretching—stretching—until it finally sensed the presence of the liquid.

In it went, with a sound so much worse than the first time we had changed it, that it was indescribable. The doctor was a trifle pale as he turned to set the kettle on the floor between us. A silly thing to do, I thought—very silly. He would be sure to get his foot in it if he left it there. And feeling better, now that the monster was out of sight, hidden from me by the high wall of its new bath, I moved closer.

As I had seen it a moment ago, and in a rounded form, it would have measured about a foot through. Now I fully expected it to come boiling over the top of the sink at the next instant. Instead it flattened out, probably to offer a greater surface of contact with the solution. It was insatiable.

"Watch," cried McInnis. Snatching up a long glass stirring rod, he deliberately pressed it into the top of the mass. It offered some resistance, though the stick drove it in. From where I was standing, peering over his shoulder, I could dimly make out the rod, pressing down almost to the very center, though not breaking its surface.

I HAVE often wondered why I did not leave the building at that moment and never return. It fascinated me—there is no way to account for it. As a crowd swarms about the victim of some terrible accident, even though the sight sickens them, I stayed and watched him change the rod for a pointed sliver of wood and poke the mass again and again. The sharp point went into the body and the thing seemed to flinch from the prod, although the wound closed up instantly after the stick was withdrawn.

Finally he grew tired of his experiments, and looked around the room until he saw a large marble slab, intended for a bench top.

"Give me a lift," he requested, "and we shall cover up the beast for the night." I was more than willing to do this; so we picked up the heavy stone and carried it to the sink. Balancing the slab on the edge of the big basin, we worked it across until it rested on the ledge against the wall. It was more than wide enough, but lacked about an inch of covering the ends.

"That's all right," McInnis said: "It can't get out of there, and such a mass of plasmodium won't hang together if it grows much larger. It must weigh fifty pounds, now."

He turned off the lights by the door, leaving one burning over the sink; and we went to the house. I could not eat; but I drank several cups of strong black coffee and, as a consequence, spent a wretched night, pursued by the horrors that one sees only in a nightmare. I felt near me terrible monstrosities, combined with gigantic amoebae that—but never mind, they were quite bad enough.

I awoke with a start at daylight the following morning and lay in bed trying to remember some vague, unpleasant experience. For a minute or two, I was unable to recall just what it was. Then it seemed, although I could not be sure, that I had been awakened by a crash from the laboratory. With a start I remembered suddenly the fantastic creation we had brought to such a monstrous size the night before. At the moment the creature seemed too weird to be more than a mere figment of the imagination; but I soon found that I could not so deceive myself about it.

I heard McInnis stirring around in the adjoining room; and within a few moments he knocked and entered, attired in a flowered dressing gown.

"Let's get started on our experiments again," he said, by way of greeting: "While you are dressing I shall get Bang Wo started on the breakfast. I want to run out to the lab for a moment and see how the thing is behaving." And he turned and hurried downstairs before I could utter a word to stop him.

CHAPTER IV

The Mass Escapes

I DRESSED rapidly, for I did not like the idea of his being alone in the laboratory. I dreaded having anything more to do with the monster, and heartily wished that it might have mysteriously died overnight. Perhaps it had done so; for it seemed inconceivable that so grotesque a thing could actually live for very long. It must be violating nature's laws in existing at all.

As I descended the stairs, I heard the Chinese cook rattling pots and pans in the kitchen. Rather than wait for the doctor to return, I decided to go at least as far as the laboratory door and call him. The door was standing partly open when I reached it, so after a moment's hesitation I stepped inside.

"Oh, McInnis, where are you?" I shouted. There was no answer. Then I saw him on the far side of the big room, bent forward and holding a mop or broom handle before him. He was standing there with his back to the light and I could not see the expression on his countenance. He was regarding something on the floor; so I stepped around the first table to see what it was.

The marble slab had fallen, and lay in pieces on the cement floor below the sink. And there, beside it, a slimy trail, dark and evil-smelling, started and led across the corner of the room almost to the doctor's feet. Prepared for almost any sight, I yet gave a gasp of amazement when I beheld the monster before me. It was flattish, irregular in shape, and perhaps four feet across; a mass of plasmodium of a dirty brown color. The outer layer or envelope was translucent and, like the dark central part, constantly altered its shape.

McInnis held a broom before him and, as I watched, seemed to be trying to sweep it back. He was an absurd figure in the dressing gown. I suddenly laughed nervously, and he looked up at me. The creature evidently did not like the broom, for it retreated slightly, by sending out pseudopodia on its other side and merging into them as they enlarged and melted together.

"See, I can herd it around," and he beamed at me; then pushed the broom at it again. Just like a youngster with a new toy, I thought, or rather like a naughty boy playing with some loathsome insect in an attempt to impress

people. I heard some rats in a cage, squeaking and rustling. Rats leave a sinking ship, I thought, as I turned to look at them.

Mice, rats, guinea pigs and rabbits were kept in cages in an adjoining room. The doctor had used them from time to time, I remembered, in some of his earlier experiments; and he still kept them, although they were no longer of any use to him. The door was open and I could see two of the cages, but the animals were not visible; probably trying to hide in the back or amongst the litter.

"IT can't get into any mischief on the floor; so we may as well leave it for the present and go to breakfast." He put down the broom and turned to the outer door. Looking back I saw the amoeboid lying motionless on the floor, and it appeared to be harmless enough then. Nevertheless, it was a brief relief to close the door and be in the sunshine as the orb moved over the eastern hills. As we walked to the house I spoke of the possible dangers in permitting the thing its liberty in the building. But we finally discarded the notion.

"I tell you it cannot grow any larger," McInnis remarked as we sat down to an appetizing breakfast.

"Well, perhaps it doesn't know that," I answered, and, relieved, we both laughed. The Chinese servant silently entered with a telegram and handed it to his master.

"I'm afraid I must leave you alone today," he announced after reading it: "Here is a radiogram from Professor Mullawny, saying he will arrive at New York today from Cape Town on the *Saracene*. I must be at the dock to meet him. He is going to need a bit of help in getting his zoological specimens safely to the institute. And, though I would rather stay here, I promised to help him when he left last year. You amuse yourself with the beastie and I shall be back with Mullawny tonight. I am sure he will be more than interested in seeing the results of our life ray."

The term "beastie" seemed if anything a trifle worse than "beast;" and I thought sardonically that the amusement I would have with the creature would be found in leaving it strictly alone.

McInnis left a few minutes later and, as I strolled into his commodious library, with the idea of finding an interesting book or magazine, the roar of his roadster burst forth as it shot out of the garage. There were some perfectos on the table; so I lighted one and wandered around the room, aimlessly inspecting the shelves. Finally my eye fell on Mark Twain's "Tom Sawyer," and, remembering the many pleasant hours I had spent in unraveling the character of the irrepressible kid, I found an easy chair and was soon oblivious to all but the quaint old Mississippi village, with its picturesque citizens.

To Look or Not

THE morning passed quickly until to my surprise the cook suddenly materialized before me and inquired my pleasure regarding lunch. Consulting my watch, I decided that one o'clock would be the proper time. After the Chinaman had left, I thought of the creature in the laboratory and wondered what it might be doing. However, I had no desire to go in to see. I went upstairs and shaved (something I had forgotten to do that morning) and, when I returned to the library, Bang Wo softly announced that the midday meal was served in the dining room.

The cooking was excellent and, although not unusually hungry, I enjoyed a good meal. While eating I debated with myself on the advisability of going to the laboratory and taking another look at the thing. But, finally, I decided that it could not grow any larger. It was out of the sink and surely there could be no nourishment on the floor to increase its size. It might die, and with good riddance too, if left alone. I did not know all the ingredients of the solution; and could not remember having looked in the sink to see whether there was anything left.

Finally, I decided to return to the library for an hour or so, and perhaps go to the laboratory later, simply as a matter of duty to the doctor. The animal had ceased to be amazing to me, though it was very real and substantial-looking that morning. I could not be a true scientist, I reflected; mere mechanics and the lighter phases of radio were more in my line. The creature, the first experiment with the large apparatus, impressed me about as I imagined an overly-squeamish schoolgirl would be impressed by having to watch a major operation.

With the book and a second cigar, I soon forgot myself. It was hours later when I heard feet pattering on the cement walk in the garden, and the figure of the Chinaman flashed by the window. A door slammed, and he came breathlessly into the room where I was.

"Big noise in there," he gasped, pointing in the direction of the laboratory building: "I hear something and look in front door. Table, the first table, reposes on one side in unconventional attitude and many things may be observed scattered on the floor. Unlawful persons may have entered, and more noises, many more, I heard from the second room."

HIS language might have been funny at any other time, but not now. I very well knew that our creation had been responsible for the disturbance.

"Get a gun—get a couple of them," I ordered, dropping the book on the table and starting for the door. Scurrying ahead of me, Bang Wo dived into a door opening off the side of the hall. By the time I had reached it, he reappeared with two revolvers.

"Here are the loads;" and he held out a handful of cartridges. I took some of them and told him to keep one weapon while I loaded the other.

We hurried to the laboratory, up the few steps, and I threw back the door. I had not explained to the servant just what he might find when we searched the building. Who could explain such a thing? He would have to see it for himself. He looked to me for guidance, so I entered first.

A small stand or table was overturned, and a number of bottles had been broken by the fall. An acid had been contained in one of them, and I noticed that it was staining the floor. It was boiling and bubbling where it had spread and come in contact with some white crystals from a shattered jar nearby. I could hear nothing for a moment; then, suddenly, came a peculiar grating noise.

Holding the gun in one hand, I picked up the long-handled broom from where the doctor had left it, and we cautiously made our way over intersecting trails of slime, past the sink and to the inner door. I noticed a single trail ahead of us which entered the room, and decided that the animal must be in there. This was verified when I heard a cry of terror from one of the rabbits or mice, I could not tell which. I had never heard a rabbit cry out; but beyond a doubt some animal was terrified.

Cages rested on the floor along the far side of the room, and one flanked the door on each side. The cook, seeing nothing unusual, I suppose, stepped inside. Just as he moved aside I caught a glimpse of the creature, larger now, and flattened against the wire mesh of the cage to the left. It appeared to be piled up against the netting, and sloping back to the floor, covering almost half the width of the narrow room. Bang was looking for a man or large animal and, before I could shout to him to get back, he had stepped on it and stumbled. In the moment

while he was falling, I noticed that the thing squeaked, like so much new leather, or a new pair of shoes.

He fell heavily on one knee, with his hands before him. The gun struck the floor with a sudden clatter, and he looked back over his shoulder. Then I saw that the plasmodium had come up around his foot, and was holding his leg fast. The outer layer, at first recoiling from his foot, had swelled almost instantly up and in over his low shoe. It was now up to the ankle, I noticed, and as he kicked and shook his limb, the stuff gave slightly, stretching like so much heavy molasses.

An Amazing Sight

STUNNED for an instant, I found myself firing into the mass. The reports echoed deafeningly between the narrow walls. The thing slowly relaxed its grip, and the Celestial, finding himself free, crawled away, tottered to his knees, then slumped down in a dead faint.

Seeing a narrow door at one end of the room, I unbolted it and, returning, picked him up by the shoulders, and dragged him outside to recover as best he could. The monster was at the door between the two rooms as I reentered. I resolved to end its monstrous life now and forever. The leaden slugs had not seemed to hurt it and, as I watched, trying to decide on a mode of attack, one of them appeared far down in the envelope of the creature, and a moment later was expelled much as one would spit a seed from between his lips. A larger, dark irregular spot next showed near the surface and I stared amazed, as a shoe came to light! It had been pulled from the Chinaman's foot, and was now cast out as of no value. Apparently the creature would attempt to assimilate all that it found in its path or might reach.

I realized that I could not harm it with nothing more than a pistol and as I stared, fascinated, it rolled along, back to the nearest cage again. I could feel a cold sweat breaking out on my forehead, but still watched, unable to move away. Something within the cage squeaked again and the netting bulged inward under the pressure of the monster.

It suddenly broke, ripping from an upper corner, and down one side. In a moment the creature was inside, or as much of it as could be crowded in the narrow confines. The jellied mass shook, stopped, and a moment later withdrew to the floor. It partially rolled over and I beheld the head and ears of a full-grown Belgian hare, disappearing within the dark center.

So it ate living flesh! No, it did not really eat, but enveloped living animals, as molasses would absorb a fly. The only difference was in the speed; for this monstrosity was fast when the occasion arose. Almost before I realized the full significance of the act, the thing was at the next cage. Then I must have gone berserk.

Darting through the connecting doorway, I spied a heavy canister containing calcium carbide. I picked it up bodily and, stepping back to the door, sent it crashing down on the beast. The mass was flattened out, and a corner of the big metal can cut down clear through it to the floor. As the container fell over on its side, and rolled down the mass, the plasmodium uprose and attempted to engulf it. Then the can was spewed forth, and went rumbling over the concrete floor, spilling a trail of the carbide lumps from its partly-opened lid.

Desperate Work

THE creature followed and seized upon a few particles of the compound, enveloping them for a second, and then throwing them sizzling out of its body. So there really was something it could not eat! The moisture had evidently started a chemical reaction; for there was a smell of acetylene in the room, mingling with the nauseating odor of the mass. I was in the doorway and jumped back as it started toward me.

My rage returned as the thing entered the laboratory room, squeezing through the door. I madly threw bottles, vials, beakers—anything I could lay my hands on. My actions did no good; though some of the chemicals maddened the thing to a fury, and it writhed and surged on the floor. Spasmodically contracting and extending, it would form a perfect sphere, then melt down to an irregular blob; but it was not still for an instant. The mangled corpse of a rabbit was expelled, quickly followed by a second and third, and the bodies of several white mice.

I inverted a table on the mass, and attempted to pin it down with the weight of the broken marble slab, which I pitched on, piece by piece. The table legs described involved figures in the air as the thing twisted and squirmed.

Then I caught a glimpse of Bang Wo in the door, pasty-faced and disheveled. He crossed the room limping and carried the pistol in his hand. I laughed as I saw him, one shoe off, and the other clattering along the floor. Then I seized other weapons as I saw them and returned to the fight. I heard an explosion, quickly followed by another, and there was the cook, holding the still-smoking weapon, pointed down to where the creature was squeezing out from under the table top. He fired again; and I called him a fool and an idiot for wasting his time.

"Pile things over it," I shrieked; and demonstrated by continuing to despoil the stock of chemicals and whatever equipment I could find, throwing them on the surging pile of wreckage. Finally he appeared to understand; and he limped around the floor, dragging up furniture and throwing it on.

The mass was moving. I could hardly see, for the fumes of chemicals were almost overpowering. The table legs continued to move, in quivers and jerks, but definitely in one direction; and, before I realized it, I was in a corner with my back to the wall. Bang was on the other side, constantly building a higher barricade. The creature was emerging on my side—it was impossible to pin it down.

I was gasping for breath, with hands pressed to my sides for a moment, when the thing, or most of it, squirmed out on the floor before me. Galvanized to action, I sprang up and forward in an attempt to clear the pile of rubbish, when a missile, hurled by the cook in his frenzy, struck me squarely on the forehead and bowled me over!

I WAS not unconscious; merely dazed. Lying on my back, I could feel the thing writhing beneath me, clutching my sides with its ever-shifting mass. Then rough hands suddenly reached over, seized my ankles, and dragged me over the bottles, cans and splintered furniture. Dimly I perceived Doctor McInnis and an elderly man peering down at me; then everything went dark and I knew no more.

When I came to my senses I was lying on my bed and someone was talking in a low tone, somewhere near me.

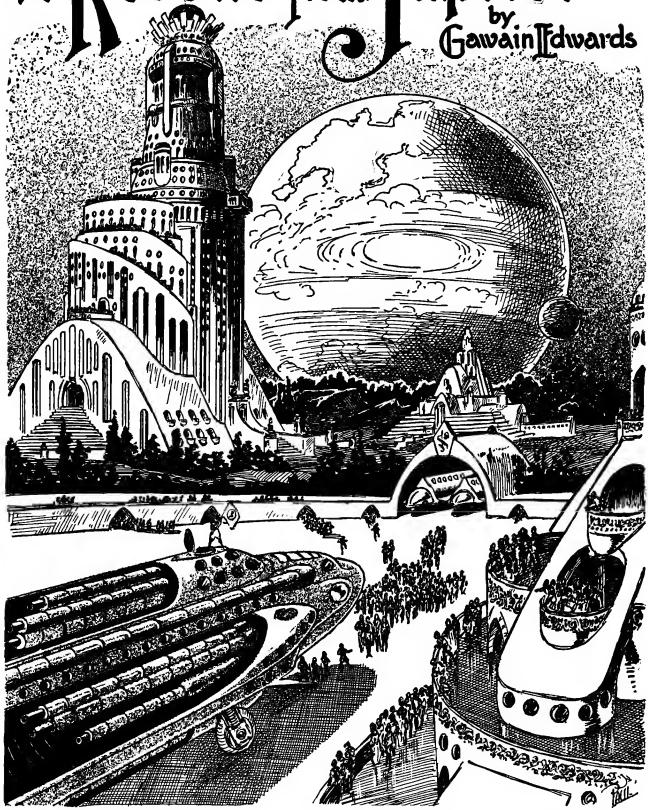
"Well, well, my boy, how do you feel now—as if you had been put through a mangle?"

McInnis stepped forward and, among other asinine things, asked me to meet Professor Mullawny, and tell him of my experiences in the laboratory. Weakly I swore at them both, as I sat up and put my feet to the floor. I was entirely too weak to get up, they told me; I must lie on the bed and some food would be brought to me. Also and above all, I must not excite myself. Then I cursed with considerably more fervor and, brushing aside restraining hands and turning a deaf ear to pleading voices, I deliberately made my way downstairs, out the front door

(*Continued on Page* 934)

A Rescue from Jupiter

by Gawain Edwards



(Illustration by Paul)

"We learn that out of the cold blackness of space they came to us in a space ship of crude design, but supplied with what seemed to be unlimited power. To go to Pleida they dared not."

A RESCUE FROM JUPITER

What Has Gone Before

An interplanetary expedition of human beings from Jupiter lands on the earth and sends searching parties to determine whether any sentient beings exist here. Allus Marce, one of the younger members of the expedition, discovers that the earth is entirely without water. He finds in one valley the buried-over remains of a great city. Drifting sand has swept up almost to the top of the buildings and obscured them. One statue towers far above everything else. Being winged, as are all Jovians, he flies up to the top of the base and discovers there the statue of a black man holding outstretched a metallic cylinder. Marce takes it and the statue immediately disappears through the base. Meanwhile beneath the statue is a great cavern in which there is a large lake. An old man lives there with his daughter and son, the last remains of the human race on earth.

The collapse of a building kills the son and so the race is doomed to extinction. We learn that the cylinder that Marce took contains the history of the race's downfall.

The expedition returns to Jupiter where the Emperor Dolmician confers honors on Carde, the leader of it, who claims to have himself discovered the cylinder and the manuscript in it. The Emperor orders the manuscript translated by his court translators. The latter reports that the script contains only a salute to Dolmician by the dying race of earthlings. Marce, enraged at all this fabrication on the part of Carde and the translators returns to Neina, one of the Jovian satellites where the house of Allus is powerful. We learn also that strained relations exist between the people of the four habitable Jovian satellites and the all-powerful mother planet.

THE relations between the House of Allus and the Emperor had always been tenuous and a trifle hostile; particularly since the time of Marce's grandfather, when the ruling Emperor of the time had seen fit arbitrarily to deprive him of some of his lands. That his father, driven at last to extreme resentment, might some day be induced to break with the central power and lead the peoples of the satellites in a concerted revolution, had long been a hope of Marce. In many ways he felt the superiority of his family to the decadent rulers of the planet. Though traffic and intercourse between the moons and Pleida was comparatively easy, with the improved space-cars of the system, and travel frequent, the widely-divergent nature of life on each body tended rapidly to develop divergent characteristics. From generation to generation, the principal stocks of the four moons and those of the planet had grown farther apart, in appearance, tastes, habits of thought and modes of living.

GAWAIN EDWARDS

Pleida, with her gravitational pull about fifteen times that of the satellites, had invested every object on her surface with frightful weight; this consideration alone was enough to condition all plant and animal life. It gave even to architecture and abstract design a decided tendency toward massiveness and broadness, which was highly distasteful to the inhabitants of the moons. Similarly, the men of the mother planet grew stouter and shorter; their bones heavy and thick; their flesh ran to grossness and their minds to cruelty and lasciviousness. Upon the lighter satellites, the prevailing lines were slender, extending upward. The buildings were tall, well-proportioned. The plants were waving fronds; the people slender and white, given to personal graces and the practice of refined arts. That these varieties had actually developed from the same original race in a few thousand generations might seem to the chance observer impossible. Yet, as the extreme adaptability of the Pleidan race had made it possible for the same people to live on worlds of such divergent characteristics, so had it also permitted these more permanent changes to take place rapidly.

Some of these considerations were going through Allus Marce's mind as he stood there before his father. The patriarch, conquering his feelings for the time being, at length descended. Laying a hand on Marce's shoulder he said, in a voice that trembled: "My son, perhaps I have wronged you. If you have been thus insulted, then the House of Allus has been insulted, and we must repay!"

"Yes," Marce replied, "but we must do it shrewdly. We must be sure that we shall succeed; for it is not so much the insult to me or to our house that counts. It is the happiness of our people!"

CHAPTER VI

The Visit of the Tellurians

THE old man was leading the way. Allus Marce followed him silently. They came at length to a locked, metallic door. Fumbling in his pouch, the elder Allus drew out a paper; reading a notation in cipher, he turned some dials on the lock. The door moved back on creaking hinges and revealed a small, dimly lighted room in which were several chests, dust-covered from remaining undisturbed through many years.

"Here are the records of your fathers before me," the old man began: "In these chests lies the history of our House; and an illustrious history it has been."

For a moment the patriarch was silent, as if watching the effect of this pronouncement upon his son. Marce, if he was stirred, made no sign. His father, after a time, went on.

"I have brought you here," he said, "to tell you what you should know about the visit of the Tellurians to Neina, many, many *deismae* ago."

Marce's eyes sparkled. He waited for his father to continue.

"From these records, so carefully preserved and handed down in secret in our family, we learn that out of the cold blackness of space they came to us, in a spaceship crude of design, but supplied with what seemed unlimited power. To go on to Pleida they dared not, because their great weight would have pinned them helplessly to the ground, unable to move a hand or finger to set their machine in motion to return them to Tellus. So they stopped with

We come to the concluding installment of this masterly interplanetary story in which events which have interested and puzzled the reader are explained in a very convincing fashion.

Although we of the 20th century are still groping blindly in our quest for the secret of the limitless energy that lies within the atom, there is no doubt but that our efforts will contribute mightily to the success that coming generations will achieve. Robert Millikan, the noted discoverer of the "cosmic rays," has shown very convincingly that these rays originate when atoms of hydrogen are reformed to build up elements of higher atomic weights, such as helium, nitrogen and oxygen. When this happens there is always a residue of energy which is left over from the combination. This residue takes the form of the energy radiation we know by the name of "cosmic rays".

If man, therefore, could only find the secret of what goes on in space every day, he would indeed achieve his Eldorado. But, as Mr. Edwards wisely shows, with such great power in our hands we must use it wisely or else the result will be our complete destruction.

us. Here, while conditions were greatly different from their own earth's, they were able to live. Their weight here was only about one-sixth that on their own world.

"Our house was then, as now, the greatest on Neina. Our forefather received these visitors with royal pomp; for despite their strangeness of features and mind, their inadaptability, and their state of winglessness, he was greatly pleased with them. After a time he learned to converse with them in a mixed speech, partly theirs and partly ours. They, in turn, seemed greatly pleased with life on Neina. One member in particular, who seemed to be the leader, became virtually one of us. There was only one thing that seemed to trouble these men on our satellite. When they came to us their skins were of a tan color; but the rays of light we receive, which as you know tend to bleach everything except the plants, soon turned them almost as white as ourselves.

"The head of the House of Allus, who was then a young man, seemed pleased by this change; since he felt that it greatly improved the appearance of his visitors, however much it destroyed their uniqueness. They, however, felt otherwise, and they expressed the hope frequently that their strange color would return to them when they departed again for home. They explained that all the men of Tellus were of a dark color, and that they would be ridiculed if they were white; which seems to me preposterous and perhaps a tale they had invented to keep us from learning the real truth.

"At any rate, they stayed with us a long time—so long, in fact, that one of the ladies of the court, herself of noble birth, fell in love with their leader. She was greatly given to his company. This feeling he evidently returned; for at length he expressed a desire to marry her. When both agreed, our forefather called physicians, had them examined as, of course, is customary before marriage. The physicians reported this curious thing: that, though they had come from totally different stocks, developing not only in different environments but even on different planets, there was no biological law against their marriage; and it was even believed possible that they might bear fine, healthy children. The ceremony took place; though the other members of the expedition from Tellus were much opposed to it and tried by various means to dissuade their leader.

"Nevertheless, the marriage was consummated. As might have been expected, the union of a member of the Neinan nobility with a member of another race was widely discussed and protested. Many ignorant persons, especially of Pleida, letting prejudices outweigh their better judgment, hypocritically appeared to consider it a kind of bestiality and heartily condemned not only the principals to the marriage, but the reigning member of Allus as well. Finally the word spread even to the court on Pleida; and the Emperor, a man fully as irascible and no less impulsive than the present ruler, took occasion to censure our progenitor severely.

"Feeling both on Pleida and Neina became heated. The Tellurians, sensing the impending disorder, begged their leader either to foresake his bride and return with them to their earth or, if he insisted, to take her with him. She, however, was unwilling to leave her native world and he, faithful to his vows, refused to leave her.

"At length, upon a frightful night, the Tellurians mutinied, and, applying power to their space-ship, went roaring off into space without their leader. A howling mob, perceiving that the Tellurians had gone, beat down the palace guards and entered this building, intent upon killing the woman who had (as they felt) defiled herself with this interplanetary love. They found, to their surprise, that the leader of the expedition from Tellus had not abandoned his bride, but that he was at their chamber door ready and willing to defend her from the mob.

"To make it brief, they fell upon him with all their weapons. Unarmed, he tore down the hangings of the chamber and beat them off with the metal rods. He flung at them the light furniture of the suite and, with the prodigious strength and cunning he had brought with him from his bigger world, he throttled many of his assailants with his bare hands. The rabble behind, unable to see what was holding them back, imagined for a time that the royal army had been called out to oppose their progress.

"When the guards did finally arrive, this terrific Tellurian, exhausted by his efforts and surrounded by the corpses of nearly a hundred members of our race whom he had slain to protect his bride, was dying of his wounds. It was then that the rabble realized what it had done. They saw that this earth-man was no beast, but a hero beside whom they were themselves but veriest weaklings and cowards. So, instead of further opposing the guards, they picked the dying man up upon their shoulders and honored him. And the woman he had married was honored thereafter as the purest of the satellite, and was held sacrosanct after he had died.

"Later she bore twin children, the offspring of the Tellurian man. *From one of them, Marce, we all descended.*"

"How long ago was this, father?"

"Almost five hundred deismas*, Marce."

"Then how is it that the knowledge of it is not accepted generally?"

"Since there were many wars during that time, the records of those days have been all but lost."

The old man paused, to see what effect his announcements had upon his son. Marce made no sign; but for a little while the elder was unable to continue.

"The other one was killed," said Marce quietly.

"Yes—but the story has been kept a secret for many generations. How did you know?"

Marce Speaks

MARCE smiled enigmatically, but did not reply. His father went on: "So far as I can see, our only heritage from Tellus is great strength, endurance—and the curious way we have of thinking, which seems to Pleidans strange and sometimes unbalanced. We have a mightly intellectual curiosity, which is not particularly an attribute of our system's races. In fact, it seems to me that, through so many deismas, there have persisted traits given us by the Tellurians."

The two men, father and son, were for a long time silent after the elder had finished. If the patriarch had expected a more violent reaction, he gave no sign. At last, he spoke once more:

"It was the aftermath of this affair, when long after a man descended from a Tellurian came to the head of the House of Allus, that caused the Emperor in his wisdom and power to reduce the rank of our House. While we are still powerful, we are no longer, as we once were, rulers of Neina. It is one of the insults—there have been many since—to which we must reply, when the time comes."

Marce put his hand gently upon his father's sleeve.

"As a matter of fact," he said, "you expected me to be greatly moved when you told me that in my veins there flowed Tellurian blood. But I have long known the story you have just related to me here. Some time ago, I

* Eight hundred earth years.

found the combination to this lock, and made my way into this very room. Here I found, among the old records of our forefather's day, not only the whole history of my descent but also, what is more important, a key made by him whereby the language of the Tellurians may be rendered into our own tongue with ease and exactness."

"What?" It was the elder who was startled at the revelation.

"It is true. Even before I left this house for Tellus I had learned this key as though it were my own language; so that, if I were to meet any members of my race there, I should be able, after a fashion, to converse with them. Unfortunately, there were none still alive, or so it seemed. There were only the scraps of paper in the metal cylinder."

The patriarch took his son affectionately by the shoulders, shaking him.

"And could you read the contents of the cylinder?"

Marce nodded.

"And yet you did not, because you did not care to let Salvarius Carde shine in greater glory than he had already taken upon himself?"

The younger man hesitated.

"Well—yes and no," he replied evasively: "That is—I could have read the manuscript—and I did!"

"You did read it? For whom?"

"For myself, and I alone know the translation."

"But the royal translators—"

The heir of Allus made a scornful gesture. "The liars!" he declared: "They forged a translation they knew would please the Emperor. What do they care for the truth?"

"But you—?"

"During the long journey from Tellus to Pleida, I had a premonition of the behavior of this Salvarius Carde, who was your friend. So, though he kept it closely guarded, I found occasion to borrow the cylinder and to make a copy of the contents secretly. These I have since translated fully. I have the translation here."

The older man clapped his hands together appreciatively.

"My boy!" he exclaimed: "And I thought you unfitted to inherit Allus!"

But Marce was not swept away by the enthusiasm which had seized his father. He replied seriously, looking directly and steadfastly into the old man's eyes.

"In fact, I am *not* fit to inherit Allus," he said: "At least not yet. For what I read in that paper, that tragic message of despair, from members of a race which may even now count me and my cousins as its only living members, has filled me with a wild desire to return to Tellus. That desire will—it must be fulfilled before the claims of Allus can affect me!"

"How so? How so?"

"I best can answer that by showing you the translation. But before I do so, my father, I must ask your secrecy until a fitting time has come to have the matter generally known."

"My boy, I promise!"

Marce reached into his tunic, and drew from a secret pocket a sheaf of closely-written sheets.

"Here is the message, then," he said, "translated as it came from the cylinder."

His father took the papers; then paused for a moment, a suspicion entering his mind.

"Can you prove that the translation is genuine?"

The youth's eyes blazed.

"This from my father!" he exclaimed.

For a moment they regarded each other intensely. Something passed between them, a psychic wave, a union which grew from sympathy of the mind. At last the patriarch gripped the younger man's hand.

"I apologize from the bottom of my heart," he said.

"It is the nature of the Pleidan race to be suspicious, even of one's relatives. Therefore, it is not among us a matter to become angry about, but to be accepted. Apparently, however, we inherit from the Tellurians a sense of personal honor not common in this larger world!"

Marce smiled in reply. "I hope so," he said.

CHAPTER VII
The Message from Tellus

THE head of the House of Allus spread before him on a broad table the sheets containing the translation of the Tellurian message. Marce stood near him as he read:

"It may be that someone, in the endless space which stretches to infinity, some creature with a mind to understand and with compassion to feel for us in our last extremity, will find this message where it will be placed. It is too much to hope that when our plight is known there will still be some of us alive; but from the dawn of life men have always struggled upward, aided by undying hope, and hope is with us still.

"Therefore be it known that when this is written, toward the close of the year 8921 after the birth of Christ, from which the human race has been accustomed to date its time, there remain but a pitiful few of the mighty peoples which once ruled the earth, and even sped among the planets. Feeling that the end is drawing near and is inevitable, we have completed the last monument which it now seems will ever be built to our race. Upon its top we have placed a figure not unlike one of us, and in that figure's hand will be put a cylinder containing this history and appeal. The grip upon the cylinder will be so maintained that it cannot be accidentally unfastened, or worked loose, except by a reasoning, intelligent being.

"It is impossible for anyone to understand our plight without some knowledge of our history. Ours is a race which has perished through its own sins. Prosperity was never good for us. We wantonly destroyed the gifts of nature. Once, when our globe was covered with trees, we cut them down. Our coal we used without regard to the consequences. Our oil we pumped out of the ground and burned away in pleasure, madness, and war.

"We were high livers. While we had the resources we maintained what we were accustomed to call a 'high standard of living.' For centuries preceding the year 7500, class distinctions had almost disappeared from among us. Mechanical appliances did most of the hard and necessary work. Through a series of socialistic coups early in the Twenty-Second Century, arrangements were made whereby all industries were administered by governmental groups for the benefit of the whole people. Thereafter, for hundreds of generations, peace and plenty seemed assured permanently. I will not say that there were no minor disasters. An earthquake in 4360 swallowed up Lower California and inundated the rich Imperial Valley. A revolution over the distribution of free power from the Texas oil fields generating plants* arose in the New England States of the North American Continent in 4889. There were disastrous fires, temporary power failures, and governmental scandals from time to time to stir up friction and cause bloodshed. But on the whole the peoples of the world, freed from the fundamental danger of hunger and want, lived in a veritable golden age. They appeared

* Which supplanted the coal-consuming power plants between 3500 and 3800.

scarcely to realize that the good times would ultimately come to an end, after the natural resources upon which they were drawing so lavishly were used up.

"It took the Great War of 7550-7596 to make the spectre of want again a reality. Within the period of that cruel and bloody conflict our civilization was almost wiped out. Fuel and energy which would have maintained the people in peace for generations were shot away. Oil wells were pumped dry. Coal seams which had previously been thought worthless were worked until they were exhausted. The last of the forests went under the axe. When the war was over we saw that our former material prosperity, which had led us to these excesses after centuries of pleasant existence on the earth, could never be regained. The natural resources of the world as we then understood them, were gone.

"Our fine systems of economics had likewise melted away. Collapsing one by one throughout the world, the benevolent cooperative agencies ceased their free distribution of comforts and necessities. Strong private entrepreneurs bought out the factories. Girls and children and men went to work in them, taking the places of the now silent and powerless robots. The whole world fell suddenly into days as gloomy and hopeless as those which marked the early years of the Industrial Revolution. Working days became long and monotonous. Women and children worked twelve hours, men sixteen. Factories became again surrounded by slatternly towns filled with wretched hovels. Buildings which had once been fine homes were turned into workshops where old crones plied their needles.

The Coming of the Water Motor

"THE chief sources of power were the waterfalls. Interesting but only partly successful attempts to harness the winds and tides had been made, but the total power derived from these sources was negligible in proportion to that delivered by the waterfalls. In short the outlook for the future of the human race at the beginning of the Eighty-First Century was more gloomy than it had ever been in its history. It was this need, more imperative than any that men had ever experienced, which set scientists and inventors seeking farther and farther afield for fresh reservoirs of power. It was this necessity which finally led to the discovery and application of the water motor.

"The genesis of this invention goes back thousands of years, to the first quarter of the Twentieth when scientists first discovered and studied the cosmic rays. They learned that these rays represented energy radiated through space when atoms of three elements, helium, oxygen or silicon, were spontaneously built up from atoms of hydrogen. A scientist named Millikan was the first to demonstrate this proposition theoretically. He showed that if four atoms of hydrogen, with atomic weights of 1.008, should combine to form one atom of helium, with an atomic weight of 4, energy would be emitted in the process equal to the fractional difference between the weight of four atoms of hydrogen and one atom of helium, or .032.*

"The early scientists, of course, were interested in the problem only from the point of view of explaining the mysterious cosmic rays which they had detected. But our men, when all ordinary sources of energy on the earth had been harnessed, used, and exhausted, turned to it as a means of releasing some of that energy which we knew abounded in earth and air and all the space about us, but which hitherto had defied release by man's ingenuity. They reasoned that in water we had a plentiful, mobile liquid, containing the two elemental gases, oxygen and hydrogen. If, by some means, the hydrogen could be readily separated from the oxygen, and built up into a gaseous element of higher atomic weight, energy would be given off in the process, either in the form of heat or radiation convertible into heat, which could be turned to practical uses.

"I will not say how long they worked on this proposition, or what the preliminary experiments were. The quest was so hopeless that the rich entrepreneurs of the country did not try to interfere in the tinkerings of these scientists, for they felt no danger to their own position. But one day—it seemed as sudden as that—the problem was solved. A scientist had succeeded in making a metallic alloy containing radio-active elements which had curious properties. Chief among them was this: When a jet of hot water, or steam, was blown upon a plate of it, a violent explosion occurred. At least part of the hydrogen of the water was changed to gas of higher atomic weight, and a portion of the energy given off appeared as heat, causing a sudden expansion, and hence the explosion.

CHAPTER VIII
Riotous Days

"IT was a simple matter to incorporate this principle into a motor. A contrivance was built similar to the gasoline engines of former times, with a plate of the new alloy fastened to the inside of the cylinder head. A carburetor passed a spray of heated steam into the cylinder; the moving piston compressed it until, coming in contact with the alloy, the steam exploded. What followed was exactly what had happened in ordinary engines. The power was transmitted through the piston to flywheels and thence to any useful device to which the engine was harnessed. The exhaust gases were let out through a vent.

"The news of the discovery spread over the world almost overnight. Millions of distraught and miserable human beings took new hope. The only men who were not pleased were those who owned the waterfalls. Cloaking themselves with civil authority, they made swift raids on the laboratories, but they were too late. Copies of the magic formula had been broadcast. Plans for the construction of water motors were already in hundreds of hands.

"The first crude motors were, of course, seized as dangerous devices subversive of the public good. Their possession was declared treasonable. But within a year a sufficient number of improved models were in use to break the power of the waterfall magnates. Many of them lost their lives as well as their property in the resulting riots and displays of mob vengeance. Wage-earners, too, foreseeing the time when they would be freed from slavery, destroyed machines, factories, and even their masters. A brief period of violence and readjustment followed. Then suddenly the billions of the earth's people began to realize what so much free power might mean to the cultural development of the race.

"The old benevolent forms of democratic government were revived and adapted to the new conditions of life. The ugly, river-side factories were razed. Every trace of machinery was removed from the world's waterfalls, and they were restored to their original beauty. The race eagerly tried to regain something of the serenity and peace which had marked the golden age of the world before the last Great War. The new power was turned to strictly

* Four atoms of hydrogen have total atomic weight of 4.032
One atom of helium has atomic weight of 4.000

useful ends, operating mines, ships and harvesters. Rains from heaven supplied the wants of men. Wage slavery ceased. Slowly, as the population recovered from the deep wounds of the horrible forty-six-year war, quiet and plenty returned. Every man became a little god upon the earth.

"Sages declared that the millenium had come. Released from his round of ceaseless toil for material ends, every person sought to spend his leisure time improving his mind. Literature, the theatre, music—all the arts, in fact, thrived as never before. It was, even in retrospect, a kindly and beautiful time, yet one in which the seeds of destruction were subtly and inevitably growing. Evil roots were working deep into the human consciousness, preparing to burst into sinister flower and to bear the bitter fruits of the coming years.

"As I, the last landed patriarch of this race, write this, I am moved with both compassion and bitterness toward our forefathers, particularly the leaders who did not see the coming disaster. It is now only a little more than nine hundred years since the water motor was perfected and its use made widespread. It seems unbelievable that, in the span of only thirty generations, man should consume all the oceans, the seas and lakes and rivers, and even the surplus moisture of the air. Yet he did this, and in so doing he almost depopulated the globe, destroyed plants, birds, and beasts, and reduced the remainder of the race to misery and slow death.

"The change from quiet to activity was not long delayed. Men suddenly grew weary of bending their enormous new power only to usefulness. It seemed too that the taste for cultural pursuits was abruptly sated. Beauty lay on every hand, and was spurned as common and unexciting. The first evidence of the change began early in the era of peace. Groups of earth-weary men began to wonder how it would be to explore the mysteries of space. Such an abundance of free power made this age-old dream a possibility if some way could be found to concentrate the power for use in rockets. At length one inventor devised a method by which this could be done. Using the power from great quantities of water to turn his generators, he succeeded in electrically manufacturing a concentrated fuel which, he calculated, would propel him to the moon.

"The uses of peace had not greatly affected the earth's water supply. It was even argued by some that this supply would never be diminished. Accordingly, there was no popular clamor for the conservation of water when several huge space-rockets were constructed, all of them enormously destructive of power. The whole world focussed its attention on the first attempts to explore the universe. As everyone soon learned, it was not as simple as had been expected. The designer of the first rocket was blown to bits before he left the earth. Two others rose from the surface, only to fail before they had gone beyond the sphere of the earth's gravitational influence. They were drawn back to earth, and killed in the final plunge.

"Nine attempts were made before one rocket, carrying a party of three men, was successful. It reached the moon, and came away with a report that the satellite was, as had long been supposed, nothing but a dry, lifeless cinder. The success of the perilous trip, however, fired the imagination of all the people. If the moon could be reached, it was argued, why not the other planets; why not, in fact, the distant suns of outer space? Almost as if by signal, the world became turbulent, emotional. Men were no longer content. The boundless energy of the human spirit, released from the constant toil which had formerly been necessary to keep it alive, now sought other means of expression. The pursuit of culture and quiet refinement was not enough. Action was demanded; danger, thrills, excitement. A year after the trip to the moon, a successful voyage was made in a larger space-car to the planet Mars. Ten years later another car reached Venus.

"Now it seemed that at last man was master of the universe. These successes, productive as they were of unlimited new knowledge, whetted the appetite of the race for ventures farther afield. At length two expeditions set out simultaneously on the long journey to Jupiter, which lies more than 400,000,000 miles from the sun. It was a breath-taking attempt; one doomed at the outset to almost certain failure. The most powerful telescopes on earth and the most highly sensitive radio devices were commandeered to keep track of those intrepid travelers throughout their flight through the bleakness and cold of outer space.

Into Space

"ONE of the rockets was lost sight of soon after it left our planet, and was never heard of again. The other, a tiny speck of burnished metal with its precious cargo of human beings, flew straight to its mark, and arrived at length upon the largest of Jupiter's moons. Long before, however, the rocket had penetrated far beyond the reach of earthly telescope or radio. For months we were devoured with impatience and curiosity, we wondered what our explorers had found at the end of their journey, whether indeed they were still alive, and if so, what had become of them.

"It was only upon their attempted return that we again caught sight of them. Their ether radio signals* caught our attention long before any telescope could be expected to catch sight of them. Something had gone wrong. Through a miscalculation, they were being drawn into the sun!

"Fragmentary messages began coming through to us. 'On the moons of Jupiter we found human beings as intelligent as ourselves—' Then the calls became frantic, incoherent. 'We were forced to leave. We had no time to make our calculations. We have lost our way—' There followed appeals for help—help that no man could give them. They described the flaming surface of the sun as they drew close to destruction. The forces of nature were inexorable; there was no escape. At last they resigned themselves and tried to tell us as much as possible in their final hours of the races they had found. But the electrical interruptions due to the sun's influence were too great. We heard only part of what they said. But we heard enough to cause fresh excitement among the people of the earth.

"If there were intelligent beings on Jupiter or her satellites, it was argued, they would be as interested in us as we were in them. Then there arose great speculation as to whether the secret of the water-motor and the rocket-fuel had been revealed to the Jovians by the voyagers. If so, it was concluded, the application of these principles by the Jovians might bring them upon us for a return visit. It was apparent that our emissaries had been forced to leave Jupiter in haste, perhaps in the face of open hostility. In that case, if the Jovians actually did visit us, would it be for peaceful purposes, or for conquest?

"So ready were our people for fresh excitement that

* The ether radio capable of penetrating the Heaviside Layer that had defied the ancients of the 20th to the 25th centuries was devised by Bartlett Graham in 2512.

the idea of resisting an imagined visit of the Jovians took instant hold. It was widely reported that the radio messages from the voyagers were said to have been translated to reveal a threat of invasion. There was tremendous popular clamor for the construction of great engines of defense in case of war. With nothing more than a rumor to go on, our people began to prepare themselves for the battle of the worlds.

"The continents became armed forts. Terrific new explosives, some based on a refinement of the explosion principle of the water motor, others like the rocket fuel, and some still more powerful, were devised. Aircraft capable of transporting garrisons as large as cities were developed and held in readiness. Observatories were erected on every promising point. At length those who at first had been terribly frightened by the prospect of an attack from space now looked forward to it. They were impatient for it to begin, if for nothing more than the spectacle it would afford.

CHAPTER IX

The Disintegration

"NEEDLESS to say, the Jovians did not attack us. But the armaments created to defend the earth from them did not lie idle for many months. There was too much turmoil; too much excitement and quick temper in the air to permit that. As we look back upon it now, knowing as we do what was happening to the atmosphere they breathed, the violent and facile emotions of those men are understandable. But in their own day the events to come were not foreseen, and no one undertook to interpret the new expressions of human temperament as mere matters of chemistry. It was assumed then, as it had been assumed by the bulk of mankind since the beginning of history, that men were being swayed only by their reason, and not by the external world.

"It is difficult to say when or how the last great war was begun in which the human race was to take part. But it started suddenly. Like a spark applied to power, it set the whole world ablaze overnight. The peoples of the earth, armed to the hilt for an attack from without which did not materialize, seemed ready, and even glad at the suggestion to turn their weapons upon each other. Hemisphere against hemisphere, the planet was suddenly rocked with war in its cruelest and most scientific aspect.

"And as might be supposed the heart of the conflict was the heretofore commonplace and despised water. Water furnished power for the marauding aircraft; water made possible the manufacture of explosives; water afforded energy for all construction, and for destruction as well.

"When a few wise men in both hemispheres pointed to the tremendous use of water as fuel and predicted a drying up of our water supplies they were laughed down or found themselves in their own land accused of treason. Inventors devised ways of using water directly from the oceans, depriving it cheaply of its salt and providing plentiful supplies of fuel for the numberless engines. Military leaders pooh-poohed all suggestions of alarm. If the water were all used up, which was absurd, they said, scientists would find ways of creating more of it synthetically. Or if this proved too difficult, they would find substitutes. What were scientists for, if not to find substitutes for the natural resources mankind had consistently destroyed?

"It must be said, in defense of this view, that not even the wildest dreamer could have believed that all the water would really be consumed. Even with the terrific extravagance of war, our supplies would have lasted for countless centuries before an actual water famine was to be thought of. The amount of water at the beginning of the conflict was so great that had all the land been depressed, so that the oceans were of even thickness over the entire globe, the depth of the universal ocean thus produced would have exceeded a mile.

"What did alarm the chemists, however, was the effect which the water motors were having upon the atmosphere. For the first time since the invention of the alloy, the exhaust gases were carefully analysed. Many physicists and chemists arrived simultaneously at the conclusion that the power of the machines was due to the fact that in them hydrogen was being built up, not into helium, as had been supposed at first, but into nitrogen. Each fourteen atoms of hydrogen in the water with an atomic weight of 1.008 each, were uniting to form one atom of nitrogen with an atomic weight of 14.008. The energy given off was equal to the difference between the total mass of the hydrogen, or 14.112 and the atomic weight of the nitrogen, 14.008. This large difference was .104, or more than a tenth of the energy in a single hydrogen atom. Naturally, a great part of this force was lost in emanations; only that which appeared directly as heat was converted into power in the motors.

"But it was not the power phase of the problem which troubled the physicists and chemists. It was the matter of the exhaust gases. Since the air in the beginning was largely made up of nitrogen and oxygen, in proportions of about four to one, the addition of fresh supplies of these two gases seemed at first thought to be unimportant. But while the *identity* of the gases in the air remained virtually the same, the *proportion* was rapidly changing. The exhaust from the motors, it will be observed, was one part nitrogen to seven of oxygen (the change following the disintegration*); also the addition of the exhaust gases rapidly increased the proportion of oxygen to that of nitrogen.

"This discovery, needless to say, was startling in its import and explained many things, including the changes in the atmosphere, the failure of chemists to discover supplies of hydrogen with which to create new oceans of water, the unheard of virulence with which the air was found to attack virtually all exposed metals, and the increasing pressure of the atmosphere. The queer giddiness and excitability of men became understandable, as well as the nutritive changes, numberless hitherto-unexplained deaths (from what had seemed exhaustion and overwork) and the general shortness of life.

"It will be observed from the formula that only a small portion of the mass or weight of the water was lost in the process of transmutation. Consequently the weight of the water which had formerly pressed only upon the earth now rested, as it were, on the shoulders of men and animals. The concentration of oxygen was becoming so great that iron, copper, brass, zinc and many other metals and alloys, if exposed, were sometimes reduced to oxides in a few hours. Breathed into normal lungs the oxygen so concentrated was taken into the blood and the physical effects were similar to that which accompanies the artificial use of oxygen in pulmonary treatments.

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*? H_2O (in the presence of the alloy)$=H_{14}+O_7=N_1+7O_+$energy represented by .104 of an H atom. The proportion of nitrogen in normal air is four parts to one of oxygen.

A New Race

"ANOTHER effect of the changing climate was the darkening of men's skins. The relatively cloudless skies had permitted the sun to beat down unmercifully upon the earth. The drying up of the shallower parts of the oceans had covered important portions of the earth with glittering salt. The glare in some regions was almost unbearable. When nature stepped in, her protective coloration produced at first chagrin and embarrassment, for it had been held a mark of inferiority to be dark-skinned. But men soon began to see that to be dark was advantageous, and the color became so popular that its coming was hastened and exaggerated by artificial stimulation and cosmetics. I do not know whether it was hastened also by the chemical content of the air, or the presence of the unused and little understood emanations from the water motors. But I do know that it came with incredible swiftness, so that in four or five generations the change from light to dark was almost as great as if the blood of a black race had been strongly fused with our own.

"While this was going on, the shortage of water upon the continents was becoming acute. Farmers were no longer able to grow crops for food. The chemists, unable to remedy the lack of moisture or to control the behaviour of the weather, came to the rescue in another way. They developed concentrated synthetic foods, thus releasing hundreds of thousands of men from the industries for the pan-hemispheric war. This struggle had entered a new and more bitter phase. The populations of the earth, realizing for the first time, it seemed, that their fuel supply was slowly diminishing, ceased fighting for the control of land and fought instead for the control of the world's water.

"The races of the Eastern Hemisphere had been most successful in the fight. They already controlled the Indian Ocean, the Mediterranean, the Atlantic, and most of the South Polar Sea. They had encroached along the shore-line of the Pacific on the Chinese side and had gained a foothold on the Pacific in South America. So furious had been the conflicts for these victories that the contents of the oceans had actually been reduced already by nearly a fiftieth of the original amount. The air was deadly with oxygen. The pressure was terrific. Many persons began wearing specially-constructed masks to protect themselves from the frightful burning of the air. Others seemed to develop a partial immunity to it, though everyone felt in some way or other the effects of the changes which had been made in the vital balance of the elements.

"In addition to these new hazards, including the perils of war, famine, and disease, we were now beset by terrifying movements in the earth under our feet. The changing pressures caused by the emptying of the ocean beds was bringing about drastic redistributions of the earth's crust. Yawning chasms opened on the continents. Volcanoes spewed out their fire and destruction upon many lands. The seas often trembled with the violence of movements going on underneath. Rushing into fissures, the waters sometimes met eternal fires deep in the earth, and came back to the surface in clouds of explosive steam. Great quantities of it soaked downward also into new caverns in the interior of the globe, and so were lost to us.

"Moved by these evidences of destruction in inanimate things, our people became like madmen. It is difficult to describe the extravagances to which they went to carry on their petty war. At one time soldiers of our race drove tunnels thirty miles underground to blast an enemy city. The enemy retorted in kind, sending upon us such a rain of aerial torpedoes that we were at a loss to know whether it was more dangerous to let them fly or shoot them down. At the expense of great quantities of power, we erected batteries which would hurl projectiles a distance of two hundred miles into the enemy camp. They protected themselves with a veritable barrage of electrical energy, laid down curtain-like around their works, and generated at the expense of almost incalculable power. It was the desire of both sides to make it a war to end all wars. It was hoped that it could be brought to a conclusion before all the water of the globe had been exhausted.

CHAPTER X

A Crisis

"THIS was the condition of the earth and of mankind four hundred years ago. Each side vied with her to produce some more daring, more diabolical or more wasteful engine of destruction or defense. Nevertheless, so great was the total quantity of water in proportion to the inventiveness of men, that even then the world might have been saved. If the war had been stopped four hundred years ago our children today might be playing in grassy meadows by the margins of silvery lakes. Birds might still be thronging the air and airships would fly serenely over the remnants of our once billowing seas.

"But in the year 8522 occurred the worst catastrophe of all. An inventor, of the Caucasian race,* experimenting in his laboratory, came upon a method whereby the catalytic alloy of the water motors** could be finely divided and scattered in water, producing in this form the familiar explosion without the aid of carburetor or initial heat. He took his discovery to the War Department, with the suggestion that the metal be scattered into the oceans, thereby setting them by spontaneous dissolution into fields of flame and vapor. Our people, perceiving that in this they had found a way of conquering the enemy at a single stroke, yielded to his counsel. They dammed off great bodies of water for their own use, throwing huge dykes across the necks of estuaries and gulfs in our control. Into the remainder, which included all that part of the sea and the ice of the North and South Poles which touched upon the shorelines held by the Asiatics, they cast great quantities of the powder.

"No sooner had they done this than the waters burst into flame like lakes of burning oil. Upheavals rent the air and caused the land to shake. The alloy settled through the layers of the deep. Far down beneath the waves the liquid began to disintegrate. The ice at the poles melted from the terrific heat. A frightful furnace covered half the world.

"The inventor who had planned this holocaust had calculated rightly. The burning of the seas did kill the Asiatics in their cities. Those who hurried inward to escape the burning waters starved in the desert lands. They were unable to come at us across the miles of flaming ocean. I am ashamed to say also that for three weeks, while the oceans burned, my people gave themselves up to the most disgusting orgies of celebration. The author of this incredible horror was fêted as if he were a benefactor of the race; he was enthroned like Nero, and like that bestial emperor he sang and played while half the world burned. But for three weeks only did the celebration last.

"At the end of that time the bones of millions of Asiatics were bleaching on the glittering sides of the salt dunes they had once held. The waters which had lapped

* Rabo Callum IV.
** Known as *perenium*

those shores had disappeared in heat and gases—to return no more.

"But something else had happened also; a circumstance which remains more or less inexplicable to this day. By some unforeseen means, a great quantity of the destroying alloy had found its way from the boiling oceans into our own private seas. Perhaps the explosions of the deep had cast the metal like fine, impalpable dust into the air, and it had settled again of its own accord in the water which had been reserved from the conflagration for the use of the Western race. In any case, the boiling and explosions of the waters spread over the globe like a loathsome epidemic, mysterious and unpreventable.

"One day a body of water would be lying still, with only the twinkle of the bright sun upon its wavelets and the sedgy grasses growing luxuriantly around the edge; the next, it would be covered with the boiling vapors of dissolution. Within a week the explosions would rock it to the depths; the heat would drive all persons living near-by from their homes. In a month the basin would be dry, a mocking glitter of salt.

"It was horrible, horrible! For a few weeks, suffering humanity, or that remnant of it which was left, beheld in wondering silence the spread of this terror over the remaining habitable portions of the globe. Then there was questioning. Scientists were importuned for aid. Rioting broke out in cities, and savagery took the place of feasts and celebration. One by one the large bodies of water, which had been reserved for use after the death of the last Asiatic, now disappeared. People, in great numbers, began to die of thirst upon the salty deserts of their own making. The inventor, who three months before, had been fêted like a king, suddenly found himself caught by a mob, and when he confessed that he had no magic whereby he could destroy the Frankenstein monster he had created, they put him to death by horrible torture.

"Still the terror spread. The number of human beings dwindled day by day. Animals, birds, insects, and all manner of crawling, running or flying things disappeared. It was as if the avenging hand of God were wiping the old earth clean again and clothing her afresh with a vegetation of brilliant solar salt, the glitter of which destroyed the eyes.

"At last the survivors, numbering twenty thousand, reached this valley at the bottom of the ocean,—a valley surrounded by high furrows which had once been mountain chains beneath the waves. By some miracle, the water here had been saved. It sparkled cheerfully in this, our last stronghold. Welcome plants were growing around the lake's broad edges. The valley was a fairyland, a promise of renewed life. All the race might gather here and create a new civilization.

CHAPTER XI

Feverish Activity

"THE rulers of the little band which settled here in 8740 were wise. They forbade from the start the unlimited use of water-motors. All but a necessary few of these engines were destroyed. The fluid of life was to be carefully husbanded. A new city of stone was to be built for all eternity beside the quiet shore—a city practically without metal, for virtually no known metal except the disintegrating alloy could endure the extremely high concentration of oxygen in the air.

"Stone, fortunately, was plentiful, and soon the city began to grow. Among this little band, the terror of total extinction was forgotten. On the placid lake there was no sign of the vapor or the explosions which had burned out the rest of the world. Men who had seen lakes, equally quiet, suddenly burst into unexplained activity, now glanced at this lake daily with the assurance that here no dissolution would come. Normal evaporation took place, of course, and there were other losses. But they were compensated partly by little rainstorms which, from time to time, returned part of the water the sun had removed. The pool was salty; at its edges the crusted crystals made a shining rim. But salt did not trouble us greatly, for methods had long been known by which it could be cheaply removed.

"But however carefully it was watched, the level of the pool began to slowly go down. It was apparent that we were gradually using up our water, losing it by evaporation and by seepage into the earth. The life of the city moved in upon the lake as it became smaller and smaller. The outer buildings were deserted progressively in favor of those closer to the cooling beach.

"The dry earth was almost windless, but there was, nevertheless, a constant fluttering of the air around the edges of our valley. On the wings of this breeze the higher surfaces began to shower us day and night with storms of sand. We reasoned that the presence of the moisture in our valley, when all the rest of the globe was dry and hot, set up atmospheric disturbances which brought the wind.

"Corps of sand-shovelers were therefore organized early in the life of the community to keep the streets and areaways clear. But from the first many despaired of ever keeping back the floods of quartz and salt which drifted ceaselessly over the cliffs upon our roofs.

"Another intense activity in the city was connected with chemical research. In one of the tallest buildings of the settlement it went on continuously, even feverishly. Our scientists, faced by the direst necessity, were seeking some secret from the elements which would enable us to restore the oceans, lakes, rivers and meadows.

"But the secret was destined never to be discovered. In a few years every method possible to us had been exhausted. Meanwhile, other difficulties began to arise. Necessity, instead of bringing the members of the little colony closer together in a wise struggle against nature, seemed to provoke internal quarrels. Disease became common and was difficult to check. So careful were we in using our wretched supply of water that often the necessities of sanitation were neglected. The concentrated, synthetic foods upon which we were trying to exist had begun to have their effect; bodies which could live on them for a long time when they were supplemented by natural foods from time to time, now began to go to pieces under the necessity of eating laboratory preparations and nothing else. And so the little community went on year after year, fighting its losing battle against inexorable nature.

"And then, in 8830, it happened. A watchman came hurrying one morning to the governor of the city with the news that the catalyst in some way had gotten into the lake.

"Looking out at sunrise he had beheld the familiar boiling in the water. Vapor was rising at a spot near its center. When, or how, or from what source that accursed bit of metal had come we could not tell; but as they gathered, the few hundreds of them, at the shore of the lake they all saw that the watchman had been right. The lake was indeed in the toils of the accursed metal. It appeared that the amount of material causing the disturbance was small; dissolution at this rate would take years. But it would, nevertheless, go on until the last drops of our precious liquid were gone, until we were left to die in agonies of thirst on the lifeless desert.

"Straight up over the center of the lake rose the vapor and expanded gas. It was faintly visible, like a thin wavering plume of incense. At its base the water boiled and rumbled, sending up huge bubbles which burst to discharge their gases out into the air. Our people cried out in despair when they saw what was going on. 'This is the end,' declared one man solemnly. 'This day we behold our doom, for nothing can save our water now!'

"'But see here,' exclaimed another, 'the amount of metal in the lake is small. Perhaps it is only a single grain, like dust. Why not let a diver enter the lake, to see if he can reach it and bring it out?'

"This insane plan took hold of popular fancy immediately, though reason would have told any of the volunteers that they could never succeed. The water in the vicinity of the metal was boiling hot, the whole lake filled with terrible explosions. In addition, the metal, hurled here and there by the violence of the disintegration of water, was skipping like a demon beneath the surface of the lake. It would be practically impossible for a diver to get it or hold it—and furthermore, the explosions would burn him up in an instant.

Madness

"THESE things were quickly pointed out by the sane ones present. But the terror of the people had already produced an enthusiasm for the insane plan. No less than ten young men came forward to offer themselves. At first only one was sent down, in a diving suit, to try his luck. He never came back to the surface. Later ten went at once, to see if by their combined efforts they could not succeed where one alone had failed. Fifteen minutes later the maimed bodies of some of them, horribly burned, were thrown to the surface. The others were never found.

"Fully a hundred of our bravest men were lost in subsequent mad attempts to remove the destroyer in the basin's bottom. It seems to me now to have been simply an orgy for self-destruction. Every attempt ended in failure. The inhabitants of the valley were again frenzied with alarm. It was suggested that heavy boats be built to move over the seat of the disturbance, letting down buckets to catch the offending metal and lift it to the top. One man went so far as to fashion a crude diving bell, in which he went down to the bottom to study the situation. When the apparatus was hauled out again he was quite dead, his body disintegrated by the intense heat.

"What appeared to be the most practical scheme was proposed by a man who had formerly been a leader of one of the gangs of sand shovelers. He suggested that a long trench be dug at one side of the lake, and that artificial currents be set up in the water to sweep the alloy into this where it could be bottled up with a dam of sand. In practice, however, this plan met with insurmountable difficulties. Such frightful currents were already being set up in the lake by the presence of the catalyst that our own puny efforts only added to the general confusion. When we had finished digging the trench we tried unsuccessfully for weeks to induce the alloy to float into it. The thing behaved as cannily as though it had been alive, as if it were consciously avoiding being entrapped.

"When we had wasted two or three months in these futile and costly efforts, we became convinced that nothing in our power would stop the dissolution of the lake. A horrible calm settled over the valley. At times hysterical, then silent and morose, the people resigned themselves to the end. Sand-shoveling was given up. The encroaching dust year after year was covering house after house at the outskirts of the city. The inhabitants, no longer animated to resistance, simply moved into empty places nearer the lake, whose level was now dropping at an appreciable rate. It was clear that between the sand and the alloy we had only a few more years of life. There was no hope—unless help should come. That brings us to my own time.

"*Unless help should come!* Almost as if it had sprung spontaneously from our hearts, the idea had taken hold of many persons that aid might indeed be summoned—from some other planet. Our desperate minds, wandering through the possibilities, returned again and again to those beings whom explorers had discovered upon far-off Jupiter. What kind of men were they? Once they had filled us with dread and alarm. Now they were thought of as omniscient and kindly creatures, ready at an instant to succor such hopeless folk as we. A project was rapidly developed to signal into space by radio and beacon, telling any chance listeners of our distress and urging them to come to the rescue. Of course we realized that only a chance of a billion to one would bring the message to the ears of anyone who understood our language. But we felt that beings from outside becoming aware that sentient earthlings existed would be prompted to come and investigate.

"It was no longer a question of saving the earth. It was a question of preserving the race, on whatever planet or in whatever condition was possible. As the remnant of a race which had once been so proud—we were humble enough now!

"Our efforts to remove the alloy had resulted in carrying it to the farther end of the lake, where the water was deepest. We chose the quiet part for the erection of our signal tower, because we felt that spot would remain free longest from the drifting sand. Out of the mountain at the valley's eastern side we quarried glossy milk-colored stone. Experts with the chisel cut and shaped it, and at length we erected a tower which was both a monument and a signal station. We assembled in it the best available machinery for radio communication, using the highest-powered ether radio that we could build. When everything was ready, we set up water motors once more, and drew from our scanty water supply the power we needed.

"At the time the first of our messages went out to the universe* there were fewer than 150 human beings still living in the colony. The others had, in the years of our occupation, died of disease, accident, toil or premature old age brought on by the too-rich atmosphere. Hardly any of us was free from some malady or other engendered by the nature of our life. There were, in all, forty-three families, and our social system, like our physical constitutions, had fallen into a state of virtual collapse. At the time we had a man who, out of habit, was called the governor; he had received the office by an election in which few had been interested. He had no means of enforcing his commands; the work of the community was done through mutual willingness—no more. We existed, in short, in a state of amiable anarchy, a condition of which poets once sang. But we would gladly have traded all the heavenly delights of such an association for despotism, had it meant plenty of water to drink, foods grown upon land, and the meat of animals.

Dark Days

"I WAS at the time sixty-six years old—a very old man as such things were reckoned. My daughter Nina was eighteen, my son Nino a year younger. My wife had died two years earlier of heart trouble brought on by the oxygen concentration. Ours was an average family, in numbers and ages. There were hardly ever any new births. Why this should be I do not know; it appeared that even the biological verities were deserting us, that our women were sterile and our men hopelessly weak and short-lived. Even had our water remained untouched by the curse, I doubt if we could have been able to keep our wretched race going much longer.

"Day after day, night after night, we sent the messages out, supplemented by light signals in every language and code we knew. But no answer came. As time passed, it became increasingly clear that no answer would come.

"Gradually we resigned ourselves to the inevitable. There was a suggestion on the part of some that we appoint a day for prayers and forgiveness, and by others a day of abandon and rejoicing, at the end of which we would all drown ourselves in the little pool of water that was left, surfeiting ourselves for once in the cool wetness of it. Of course, the sane ones among us hastily vetoed this plan. Two general councils of the colony were called to discuss what should be done, but both broke up with disagreements and bad feeling. All were oppressed by the hopelessness of continuing our resistance; yet most of us shrank from a violent end.

"This feeling was intensified when the members of two

* 8916

families formed a suicide pact and actually killed themselves by cutting the veins of their wrists. The horror which attended the discovery of this deed, more effectively than any exhortation, turned the rest of us from the thought of suicide. The community went into a state of religious frenzy thereafter for several days. One young fellow who set himself up as our spiritual leader held a series of "revival" meetings in the great hall of the town. Aided by the twin compulsions of fear and hysteria, he was singularly successful in producing unusual results among his congregation.

"I mention these things because they are indicative of our state of mind at that time. We were in the darkness that is said of the affairs of men to precede the dawn of a new day. Baffled in all our efforts for survival we had given in to the inevitable, relieving our despair with such nostrums as were at hand. Religion was one of these. Another was aimless toil of such a nature that it robbed the mind of opportunity for activity. One of these occupations was the building of a giant pedestal that should tower above all the other buildings. At its top we set a statue of a man and in his hand we placed a cylinder of the non-rusting metal alloy, to contain a history of our race. To me was given the task of writing that history. We still hoped that rescue would come from the heavens. Therefore we arranged it so that if any of us were still alive, the removal of the cylinder would set in motion machinery which would cause the statue to disappear through the base. But if we were all gone, there would be no reaction and the black figure of a man would remain for all times atop our milky shaft, a monument to a dead and forgotten race.

"In the building of this monument to the race the few members of the colony sought relief. Rapidly it grew to completion. Nino, my son, every day took his pick and bar and walked to the quarries, where he, with others, delighted in hand-working the stone during the daylight hours. Heaven knows what he expected to gain by such primitive toil. He pursued his labors quietly, in moody silence. Whether there was in them the working of a blind instinct I do not know; but it was through them the cavern was discovered and new hope stirred in the colony.

CHAPTER XII

Water!

"I SHALL never forget the day when he came racing over the flat, sandy bottom of the valley to us, shouting the news that his pick had burst through the rock and that an empty space was beneath it. He stopped two or three men on the way, gesticulating, trying to explain, but they only smiled and turned away indifferently. Insanity taking many forms had become common among us. They marked Nino down as another case of dementia. But at length he came to me, so out of breath that he could hardly talk.

"'My pick broke through,'" he said. "'Water—water—under the mountain!'"

"Alas for our human incredulity! At first I looked at him as the others had. I hurried him into our house, and made him lie down.

"'I'm not crazy,'" he insisted. "'I saw it. A cavern under the mountain. And in it there is a lake of water, and from the ceiling there comes a kind of chemical light!'"

"He went on, piling up such details, until I could not but be convinced. I called on the governor and laid the facts before him. It could do no harm to investigate, I said, and if there really were a cavern as the boy had said, it might mean the saving of all of us.

"At length he agreed, and two men were sent to investigate. They were gone less than an hour, and when they returned they reported that there was actually such a cavern. It was like hearing a reprieve. A great body of fresh water, untouched by the burning metal!

"The governor immediately called us together on the beach of our boiling sea. All came except those who were so overcome by disease that they could not leave their beds. A sorry lot we were. Many were haggard and emaciated, worn with worry and dread. Others had been crippled by work in the quarries, and clad in tattered garments stood upon makeshift crutches. All of us were ill-nourished. Even the strong bodies of the young folk, including those of my son and daughter, who had both insisted upon working in the open air, showed the horrible effects of our strange life.

"'A great cavern has been discovered—' said the governor quietly, motioning with his arm toward the mountain range across the lake. 'It may mean life for us! There was a catch in his voice; for a moment he could not go on.

"At this pronouncement, the members of the crowd appeared to be stricken dumb. There was no shouting, no sobbing, no hysterical weeping, as I had expected. Somebody mumbled a prayer; I could not tell who it was. As they stood there, two men slipped to the ground, overcome by weakness and disease. The meaning of the governor's words at last penetrated the crowd. They moved suddenly, like a band of sheep, toward the mountain.

"A few strong men made a larger hole in the rock with their picks, and stared down into the blackness below. There, surely, was water; and from above rolled a heatless flame which supported and made possible a strange and ghastly vegetable life. It was a life unknown on the surface of the earth, life that had developed in this underground cavern away from the sun.

"All crowded close to view the wonder. Many were for letting themselves down immediately into the opening and plunging their weary bodies into the cool lake. But the governor restrained them.

"'It is our last body of water,' he declared. 'So far the mineral which has destroyed all the rest has not reached here. *We must not let the outer air get at this lake.* Instead let us tunnel under the ground and enter the cavern from its own level. We must screen and filter the air we let in and guard in every way the precious moisture.'

"Aghast at the prospect of so much work, but nevertheless obedient, the crowd fell back. Stones were rolled over the jagged opening Nino had made.

"Then began the cruelest period of all. Weak, worn and hopeless as they were, my people threw themselves into that frightful labor, digging tunnels both from the largest building of our stone city of Mansende to the cavern, and from the bottom of the hollow signal tower we had erected in the drying lake. Before we started, a chemist was lowered into the cave by ropes, to test the vegetation there. He reported that the water was sweet and good, and that in it was a species of bloated fish, that would help sustain life. Further, he reported, the vegetation would supply us with a kind of pulpy food as well as fuel.

"The flame of hope again leaped high in human breasts when the work began. Into the hollow milky tower we sank a shaft, and under Mansende another. And from these shafts level tunnels converged upon a spot we had selected to serve as an entrance to the cavern. It was slow, terribly exhausting work, accomplished only by brute force with little aid from machinery. We no longer had machines. The art of working metals, thanks to the corroding atmosphere, had virtually disappeared. We were reduced to the implements of the stone age as we burrowed like moles under the ground. The work day and night went on in weary shifts.

"Man after man died at his toil. Still the rest kept on, without a murmur, without a protest. For it was not themselves they were working for, but for posterity. No man insufficiently nourished, with only half enough water,

struggling with blunt tools and archaic methods, would ever sacrifice himself for his own life alone as these men did. He would rather die in torment than stand the torture of the shafts and tunnels. Yet the members of the colony did it, realizing, many of them, that they would never live to see the completion of the task.

"I was often a sharp critic of my people, speaking of their narrowness, their tendency to quarrel over nothing, to fight and kill without provocation, to be petty and childish in their relations with each other and with the world. But I had cause to be proud of them on those last terrible days. With the desperation of both hope and hopelessness, they drove those tunnels to completion! It was as if, in that final great attempt, they had tried to atone for the destruction they had wrought on the ancient earth, for the cruelty and wantonness of their wars and the wastage in earlier years. With an eye only to preserving their race, not themselves, they fought against death itself to make a habitation in which the coming generation could continue life.

"And in view of this tremendous sacrifice, what happened seemed like a cruel, merciless jest of fate.

The Nemesis

"WHEN the tunnels had been completed, one linked the cavern underground with our signal tower from which every day the desperate appeals still went forth into the heavens for aid. Another linked it with the fast-disappearing city of Mansende, which we had planned to abandon as soon as the underground works were ready, and a third with the bottom of the tower on which the statue had been erected. The creeping sand by that time had covered nearly all the outlying buildings. As a result it had become the custom of our women, only thirty-eight in number, to band together in one large stone building for mutual companionship while their men were at work.

"It happened on the day that the huge air-filters were being installed to keep the atmosphere of the cavern clear of the destroying alloy. All the men of the settlement except a few who were too ill to help, had been called out to assist in the construction of these filters. In addition, Nina, wearing the attire of a man, and insisting that she was as able to take a man's part in the work, was with us.

"A sufficient supply of power for our final operations was of the greatest importance and it had been decided to set up additional wave-motors. These machines had lain for a long time unused and their condition was none too good. Furthermore, we had no expert engineers left to inspect them for us. The men chosen to tend them were selected not for their knowledge of mechanics, but simply because of their unfitness to do other tasks. It is to these circumstances that I attribute the disaster which occurred, though of course I do not know, and no one will ever know, what really happened.

"It was about three o'clock in the afternoon. Nino, myself, and two or three others, including Nina, were working on the farther side of the lake beyond the signal tower, when without warning we were thrown from our feet by a terrific explosion. I remember thinking at first that it was an earthquake, for the shaking of the earth was similar to the trembling of the earth which the race had experienced following the disappearance of the oceans and the subsequent readjustment of the continental levels. My next thought was that the stone walls of the mountain had given way and the cavern fallen in. But it was neither. There had been a frightful explosion in the vicinity of the water-motors. The whole battery of them had been blown up as cleanly as a bubble is pricked.

"The roar of the explosion and its echoes were still ringing in my ears as I rose to my feet and staggered about to give aid to my companions. Barely able to walk, we decided that the first thing to do was to take account, to see how many had been killed by the explosion. We numbered the men who were still visible, and learned that twenty-one had been killed outright. Several had disappeared in the blast; the others were mangled, dead or dying. Only a scant dozen, counting myself, Nino and Nina, were left. All of us were dazed, stricken by the double shock of the concussion and the knowledge of what had happened to our companions.

"When we had assembled the living and done what we could for those about to die, we turned toward Mansende. Our hearts were weary, already too used to suffering to be much further moved by a new pain. Nevertheless, when we had proceeded about half of the distance from the shore of the sea to the nearest buildings I heard a hoarse cry. The man ahead of me darted into a shambling run, waving his arms. Then we all perceived what had happened. The huge hall where our women were kept had tumbled in under the combined pressure of the sand and the decoy of the rotten stone and mortar. Just as in the days long past, a shout was sometimes sufficient to loosen a frightful snowslide on the mountains, so had the blast in the valley been sufficient to precipitate the crumbling of the hall, which might otherwise have stood for years.

"Like madmen we hastened to the spot. It was apparent at first glance that there was no use to tear away the stone. Not a sound, not a cry or scream came from that still, crumpled pile. All who had been inside were dead, beyond a doubt; the women, children and young girls—all except my Nina.

"Then I silently thanked God that I had permitted her to go with us to the work. The other men hurled themselves at the ruins. They were lunatics, crazed at last with grief, horror and hopelessness. I saw staring madness in their eyes, tortured twisting in the muscles of their faces. I said to Nino and Nina, 'We had better go and leave them for a while with their grief.'

"But already the others had forsaken their struggle with the stones and were staring at us. No longer did they look like the friends and companions I had been working with an hour before.

"Seeing us standing apart, they beheld us suddenly as strangers untouched by the disaster with my whole family still at my side. In their frenzy they saw some evil sign in that. Their crazed minds somehow connected me with the catastrophe which had wiped out their own chances of posterity and made mockery of the toil of months.

"I saw that it was already too late to leave them peacefully. One was pointing at us, gesticulating. He babbled incoherently. His eyes were ablaze with an unreasoned hate. With Nino following in our rear, his pistol drawn to give battle if any of them attacked us, Nina and I hastened to the entrance of the Mansende tunnel which would take us through to the cavern and safety.

"We reached the door of the building. Nina had already started down the long stairs to the bottom of the shaft. It appeared that we would escape without trouble, but at that moment the madmen lunged into a concerted, insane attack. Shouting and hurling stones, they first sought to grapple with Nino, who was retreating stubbornly toward the portal of the building.

"At the door he drew and levelled his Kappa-pellet pistol* and fired. It was our only chance; they would have killed all three of us had we not taken such desperate measures. And so at the end—with the race almost wiped from the earth—we were still at the age-old game of men killing men!

"I shudder to relate the gruesome incidents which followed. With stones, clubs, and the deadly pellets we drove them back, but they came on again, now armed themselves. In all my life I have not seen such ferocity, such mad determination to kill. One by one Nino brought them down; he was a strong defender, and he was moved to excesses of heroism by the knowledge that upon his strength and skill depended the lives of his aged father and his young sister.

"In addition, protected as we were, we had the advan-

* Invented by Partremo in 8012. Fires a pellet of concentrated bulolic acid that eats away human tissue instantly.

tage. The battle, it soon became apparent, could have but one outcome.

"THE area outside our door was a shambles. Unable to realize the hopelessness of their attack, or so crazed they did not care, our assailants now remaining threw themselves at us again and again. The wounded and dying, unable to do more than lift a leg or arm, still tried to come at us upon the ground. Upon expiring they cast upon us such glances of hate that I shall dream of them until my dying day.

"After what seemed hours it was over. We were saved.

"But Nino was wounded. Stones and bullets had struck him. He was exhausted by the struggle. Tenderly Nina and I carried him down the stairway and through the long passage to our new home. We gathered up the strange, wild plants about the cavern floor and made him a bed. Food we brought him, and quantities of the abundant sweet water of the ebony lake.

"For many days he lay between life and death. We nursed him continually, cherishing the tiny spark of life. At length he began to heal. Eventually he recovered, though one arm remained stiff and almost useless.

"Now we were faced with the gloom of our new world. The three of us, disheartened, despairing, yet hanging on to life somehow felt that on us depended the prolonging of the race. I confess that we pondered again and again that awful problem which was nameless and unspoken among us, but nevertheless uppermost in all our minds. *How should we reproduce and carry on without committing that which had been thought an unforgettable sin these many thousands years?*

"But I cannot dwell on that now. We are placing this manuscript in the cylinder to await a rescue from space. I am continuing the story, keeping it up to date so that if we die without release from our predicament, a possible visitor may know how we fought to the last.

"Nino has meanwhile fixed the statue so that if you who take this message observe the ebon figure to fall through the crystal tower, and a trapdoor to appear in its place, you will know that some one or other is still living in the depths, crying and praying for rescue at your hands. Please then, open the trap as follows: tap five times smartly on the door. Then wrench it open with the little lever which will appear. You will then find that the descent of the figure has brought up a fibrous ladder from below, down which you may climb to the passageway.

"When the last of us feels that death is near he will set an automatic contrivance that will break the contact of the machine, and seal the tower-top forever against approach. If it be true, Discoverer, that when you take this message from the ebon hand, it move not, then you may be assured that there is nothing living on the earth; that this cavern is our tomb.

"Then let the death of man be a warning to all the other races of the universe: *that man by science, can aid himself to reach heights unsurpassed; but that by science he can also destroy himself, and is likely to, unless he is guided by wisdom rather than passion.*"

CHAPTER XIII

Difficulties

THE father of Allus Marce laid down the last sheet of the translation with a trembling hand, and stared across the table at the quiet youth.

"Marce," he said, his voice throbbing a little with the emotion the document had aroused in him. "What did the statue do, when you removed the cylinder?"

"It turned half way around, and disappeared through the tower."

"Then—they are still alive?"

"So I have reasoned."

The two men were silent for a long time, contemplating this tragedy of a dead world, and the compelling call across space for aid.

"But now——who knows?" ventured the elder. "Perhaps before this they have all died. It takes months, as time is measured on Tellus, to make the trip. Nearly a Tellurian year has passed already since you took this message from the statue's hand——"

He went on, musingly, but Marce interrupted impetuously.

"Then there is all the more reason for haste in making a return trip!"

"A return trip?"

"Of course. We must return and rescue them. Think of it, three persons, blood relatives perhaps, suffering there in a cave, waiting for death. And we two are the only ones in the universe who know their plight!"

The head of the house of Allus tapped the table-top with his long white fingers.

"It appears that you are not aware of the difficulties," he said.

Marce replied with vigor. "Who should know the difficulties better than I? Haven't I already made the journey?"

His father stopped him with a gesture.

"The mechanical difficulties I will concede to you," he said. "It was the political difficulties of which I spoke. Do you not know that Dolmician has forbidden anyone else to leave Pleida and her satellites without the express permission of Salvarius Carde, who is now Minister of Space Exploration. Do you think you could get Salvarius Carde's consent to let you make this trip, even if other details could be arranged? Would it not be somewhat difficult to explain to him how you came by the information here contained?"

The patriarch tapped lightly the Tellurian manuscript. "And if there were a return voyage, do you suppose Salvarius Carde would let *you* lead it, you who were the youngest of his companions, and the man whom he saw fit to ignore in claiming the glory of the find?"

"But we could go—without his consent."

"That would be a declaration of civil war. The legions of Dolmician would descend upon us in much less than the time it would take you to return from Tellus."

The old man saw the light of battle suddenly leap into the eyes of his son. But he held up his hand to stop him before he could utter a word.

"I know, I know," he said quietly. "It is what we all want—but the satellites are not yet ready for revolution. We are not yet united. We lack a strong young leader whose past exploits have proved him able and worthy to lead the whole group into battle against Dolmician and the despotic Pleidans. We need—" the old man's voice wavered for an instant—"power. We have at this moment no weapon as great as any that the Pleidans could bring against us."

"Have there been overtures? Have the other satellites spoken of revolt?"

The patriarch nodded.

"Often," he said. "But I am too old to lead it, and others are afraid."

Marce was silent. His father gripped his arm and continued:

"It is a thing not generally known among our people, Marce, but our engineers have finished a careful survey and have learned the truth. Our satellites have long depended upon their internal heat, generated by chemical changes, to make life possible. Within recent years there has been an alarming diminution of this heat. We are threatened with slavery from Pleida, and with freezing and starvation from the moons on which we live. These are the things which are rapidly bringing our affairs to a head, yet we rulers dare not tell the people for fear it would destroy their courage."

"What our people need," replied Allus Marce after a time, "is an issue—some emotional point of contact upon which they can unite. In addition, before the rebellion could be a success, we need a new source of power to supplement our waning internal fires and to drive our war engines."

The old man nodded, but did not speak. Marce continued:

"I am beginning to form a plan. We will build a spacecar—secretly—according to methods and designs I know. We will assemble most of the members of the crew which Salvarius Carde took to Tellus with him; they are his enemies and they will work with us. In the meantime, I will quietly acquaint our leaders with the purpose of the rescue voyage to Tellus. We will show them the Tellurian document. The heads of all the satellites will learn of it and keep their counsel.

I Will Lead Them

"WHEN everything is ready we shall take off for Tellus, secretly if possible. The Tellurians have the key to our problem, for with their water-motors we could use our seas to furnish power to use against Pleida. It is common knowledge that there is more water than land on the satellites, while on the planet the reverse is true. Even if they should get hold of our secret, we would have the best of the Pleidans there."

"You are assuming, then, that the Tellurians are still alive?"

"Yes."

"But if they are not?"

"Then there will be nothing left for us but to fight with what weapons and cunning we have. I will lead our people, if they will follow me."

Marce spoke simply, gently, yet with a firmness that was new to him. The head of the House of Allus rose and placed his hands firmly upon the sturdy shoulders of his son.

"Now, Marce, I am proud of you!" he exclaimed. "It is the first time you have spoken like a man. No more a boy now!"

Marce smiled. "But what am I?" he asked. "Pleidan or Tellurian?"

"Neither, and both. In you are mingled the bloods of two great peoples of the solar system, and in you are the combined strengths of those races. You are a fit leader for the war I have so planned and dreamed of—our war of liberation."

"But now as to our rescue trip—"

"It will be dangerous and difficult, building your space flier without Dolmician getting word of it."

"Nevertheless, we must do it. And we must hurry."

"I'll give orders for beginning it at once," said the patriarch. "You will have full charge. God grant your journey will not be in vain!"

CHAPTER XIV
Fire in the Lake

AN OBSERVER, standing upon the rim of the valley, in the midafternoon of this summer's day, would have been struck by a quality of deadness about it, for in it nothing moved. It was a sand-ridden waste, in which the sand had all but wiped out the last traces of man's former presence. The burning sun passed almost directly over the hollow, filling it with an intense, quivering heat. The white valley floor gave back the rays. The air flickered as if protesting against the pressure of the sun.

More than a year and a half had gone by since Allus Marce had alighted on the tower and taken the precious message. The last of the stone buildings of Mansende had crumbled into ruin. In the fast-filling hollow two objects still attested to the fact that men had once been there; the tower, and a jagged wound in the side of the mountain which formed the valley wall, where the stone had been quarried. The quarry edges were still sharp and clean. Its only defect was a small hole toward the back and near one side, where Nino's pick, bursting through, had exposed the cavern.

So much for the appearance of the valley; an observer would not have long contemplated it unless he were a student of abandoned lime-kilns, or of hellish spots where no form of life could exist. But he would have been struck, had he been standing upon the mountain to the east, by the endless reverberations of the air and ground, sometimes more felt than heard; the sense of an incessant pounding going on under the earth. They filled the hot basin with their echoes. There was a sense of imminent danger in them, as though the mountain contained a demon who was now springing by his subterranean home.

In addition to the sound there was one more evidence that something under the mountain was amiss. The little pile of rocks which had once masked the entrance from the quarry to the cavern had been tumbled slightly aside. From the opening there was now issuing a stream of heated gas. It moved upward silently into the intense, cloudless sky, hardly visible except for the aberrations the heat of it produced in the still air.

Through the cold, illimitable distances of outer space came one ray of sunlight so precisely aimed that it passed through the stream of gas and into the hole, and played on the surface of the waters underneath. Its sparkling reflections made more luminous the natural radiance of the cavern's roof. It disclosed that there were two persons living in the cave, beside the lake.

One was lying on a pallet of herbs and leaves. The spattering sunlight played upon him with a gaiety which mocked the hot air. Nina was sitting beside him on a little tussock of fiber she had made. She, too, was watching the sun, wondering if another afternoon would still find them there or whether, when the distant orb again lighted the cavern, it would sparkle on emptiness, finding the frail moving ferment which had been man gone forever.

For it was clear what had happened to the precious lake. The disintegrating alloy had fallen into it, gaining entrance either through the pick-hole at the edge of the roof, or through one of the unscreened passages. From the nethermost parts of the huge underground room came rumblings and explosions. The roarings were augmented by reverberations which passed a dozen times across the cavern. Fresh thunders arose endlessly from the heart of the lake. The shore-lines of the pool had drawn together until the lake occupied but half the space it formerly had filled. It was an all-too-evident fact that life in the cavern would soon be as impossible as in the hot, dry valley outside.

The old man on the pallet was dying. His eyes, half-open, were content to follow listlessly the westward course of the sun, marked by the eastward progress of the splash of sunlight on the lake. He saw that upon the water, cast over and over by the turbulence, innumerable mottled bodies were floating, some already in a state of decay, others just dead. The horrible mud-animals of the cavern depths, attacked by the curse which man had loosed upon himself, were already going the way of all other life. The air was filled with steam, with mingled gases, and with the strange, corrosive compounds produced by combustion. It was hot and stifling, and when one breathed the nose and throat were burned. The old man had a damp cloth over his mouth to protect his lungs from the fiery contact. Nevertheless he clutched repeatedly at his throat, as if with his long talon-fingers he could remove the oppression of the atmosphere.

Nina had resigned herself in stoical fashion to whatever might come. Outwardly she was content and calm. That death would come this week, or next, or this year, or next year could make little difference to herself and her father. Life held no promise for either of them; there was no use to carry it on. Yet in her eyes was betrayed a furious conflict. They were rebellious, though her lips were relaxed and quiet and her slender hands content in her lap.

The old man, lucid for a moment, turned upon his bed. He gazed at her, and reaching out, he took her hand.

"We have lost, my daughter," he said, "and we must be content to follow where the others have shown the way."

"Yes," she answered bitterly.

But a little later she burst out:

"What good is life? On this old earth our people have lived for a thousand generations. Once they owned and mastered it. Billions of them lived and worked and struggled, survived adversity, planned for their children's children through the ages. Yet it has all come to nothing. It is all ended under the stone which the sand and salt have covered up. What has the race achieved for its suffering? Death and extinction!"

"No, Nina, no," the other replied. After a little thought, he went on:

"Our physical achievements—they have gone the way of flesh and dreams and all that men have set great store by. But still we cannot say that life was wasted, for every life was worth the living, even though seemingly it came to nothing."

The girl spoke softly, "Our people are dead. With me the race ceases to exist. There will be nothing in all this universe to mark its presence or its passing except the shaft, which may survive the sand. Meanwhile where is your beauty now, your strength, your justification for all the suffering and struggle?"

The old man faltered in his reply. Tears came to his eyes.

"It is an age-old question," he said tenderly. "Nina, with all our science, with all our hard, cold knowledge of the universe, we have never answered that frightful, paramount question; *Whence have we come, and where do we go?* Neither has it been opened to us, the answer to our importunate *"Why?"* In this direction we stand at the end of the world exactly where we stood at the beginning of it; and those of us who have seen much, and suffered much, and thought much, can only trust in something, as did the cave man in his graven images, the priests in their avenging gods, and the Christians in their Trinity. We can—*we must believe*, Nina—that somewhere there is a compassionate Intelligence who rules all things. Either that or we must believe that there is nothing—nothing—"

He turned away wearily, emotion and weakness making him speechless. The flickering pool of sunlight moved steadily eastward across the surface of the lake. The level of the water was going down with alarming rapidity. Steam filled the cavern, almost blotting out the light.

It would soon be night in the world outside, a night which the old man feared would be his last. He shuddered not at the approaching specter of death, but at the dreadful fate in store for Nina. With him gone, she would be left to face the future alone.

The water in the cavern pool could not last more than a few days—a week at most. For eighteen days now the ferment had been at it. For more than three years they had lived in the cavern, sometimes filled with hope, at others times cast into the deepest despair. But always there had seemed a chance that life could be continued until someone would come to the rescue. But one morning Nina had come screaming and incoherent into the tiny cave where they had lived, declaring that the ebony lake had taken fire at last. The Nemesis of the race had sought them out again.

Then they had known it was the end.

"Nina," the old man had said, "We have just time to put our affairs in order, as does a prudent man when he knows Death is at band. We will tidy our house, so to speak, and go to our eternal rest bravely and with preparation. We must behave as befits the last members of a brave and worthy race."

"But do you think it is too late for rescue? We have a few days yet." Her voice had been quiet, reserved. But the old man shook his head.

"Too late," he said, "only by the merest chance could we be saved now. I think it is better for us not to expect anything. If rescue were coming from the winged creatures which Nino said had taken our message, it would have come sooner."

Nina nodded agreement, reluctantly.

"I suppose so," she said, "but still I have a feeling—that we should hold on a few days.

"Last night it came to me strongly in a dream. It seemed that we were beset by strange animals, which had driven us to a cleft in the rocks and were about to seize us. You had given up the struggle, declaring that all was lost. It seemed that there was no possibility of escape or rescue, for we were cut off on one side by steep walls of rock, and on the other by the beasts attacking us.

"But then, at a time when another moment would have been too late, we beard the whirring of giant wings. Looking upward we beheld men in the air above us. I could not see them distinctly but I felt they were intelligent, able men, fully formed as were any earth-men, except that they were snowy white. On their backs were fastened broad white wings which they managed as birds do. They alighted on a rock nearby and drove back the animals and rescued us bodily from imminent death.

"Of course, father, you will say that it was only a silly dream. Yet so vivid was it, that I cannot put the vision out of my memory. There was one whom I have never seen—yet someone, too, whom I seemed to have known for a long time. When the rescuers carried me upward over the cliff this man held me close to him in his powerful arms. I saw that though he seemed of another race, a being literally from another world, there was at the same time something very human about him.

"Today, when I saw the plumes of gas rising from our lake and knew that we were confronted with the end of everything here, it came to me that the dream was not a mere fancy. It was a prophecy. I felt it. I know that we will be rescued!"

There were tears in the old man's eyes when he replied:

"My child," he said, "I wish that I could believe it too. It would be happier so for both of us. But Nina, I am sure that a wish has inspired your dream. Your desire to be saved, coupled no doubt with your youthful, unsatisfied desire for love, is expressed here. In the age when men believed in miracles and prophecy we might have placed faith in this. But science long ago taught us that dreams are never prophetic; that at the most they express to us, often through symbols, the wishes and desires buried in our subconscious selves."

Nina shook her head impatiently.

"I knew you would say that. It is what I have repeatedly tried to tell myself. But father—science may be wrong!"

She had faced him with this declaration so fervently, with such seriousness and intensity, that he looked away hastily. He tried to speak gently, placing his hand upon her arm.

"Nina," he said, "I perceive that you have fallen in love with this curious man-being of whom you have dreamed. I can only say—cherish your dream as you would a reality. It may bring you peace and happiness. We must face the end soon together."

The Last Wish

As well as they could, they placed the meagre details of their lives in order as persons might who were under sentence of execution, and knew that there was no reprieve. The old man had gathered his writings and placed them where they could be preserved for anyone in the future who should be interested in inspecting them. The little cave they tidied up for the last time, partly closing it. In that vault they intended their bodies to lie when at last life could be maintained no longer.

Finally the old man asked: "Was the statue broken when Nino's 'bird' sprang the trap?"

Nina shook her head negatively.

"It fell free down the shaftway, as he had planned," she explained. "Its weight carried the ladder up, and in return the increasing weight of the ladder deadened the statue's fall. It is at the bottom now, sound and whole."

The old man appeared to consider this information.

"We planned it as an everlasting monument to the figure of mankind," he said. "We wanted it to rest for eternity atop the shaft if we should die here unrescued. It is my desire, Nina, that we respect the race's wish and return it to the top."

The girl breathed rapidly.

"I have been thinking of it, too," she replied at length, "but—I can't do it alone. I have neither hands enough or the necessary strength to raise the statue."

"Then I will help you."

"But you can hardly walk."

"I will not be called upon to walk much more. I will give all my strength, if necessary, in performing this last task."

"Very well," replied the girl. She was plainly reluctant to permit him to sacrifice himself needlessly. "But it will be hard, even with both of us working at it. We lack Nino's knowledge of the mechanical principles of the mechanism."

"Even so, we can do it," said her father impatiently. "Please help me walk through the passage to the tower."

When they had given seven days to the labor of it, the statue was again in place, the trap-door closed, and the tower sealed. The old man, true to his word, had given virtually the last of his strength to the enterprise. Nina had carried him, more than aided him, back to the cavern of the never-ending fire.

There she had laid him on the pallet of herbs beside the diminishing lake, where he could watch the sunlight when it played upon the waters. For herself she had made the little tufted seat nearby where she could sit and look after him.

It was on one such afternoon, when she had been permitting her mind to wander over the gruelling labor of the last few days, that she gave a sudden cry of alarm and despair.

"Father," she said, "do you realize that if they should come to rescue us now, we have cut off for them the only avenue by which they might reach us, and the only sign by which they would know that we were still alive?"

The old man turned to stare at her.

"Why!" he asked. "We are still living, and I have not turned off the automatic device which will cause the statue to remain fixed on the tower."

"I know," was the reply. "But we failed to attach the mechanism when we put the statue up. Now it is too late. The locks have taken hold and we are sealed in. No one could enter if they tried, unless they blasted the tower down. And lacking proof that we are still here to be rescued, they would hardly do that."

The old man continued to look at her, without answering.

Beyond him, in the pool, the dancing sunlight was nearing the eastern end of its daily path. Soon it would disappear. Then, without warning, the ground and the interior of the cavern trembled with violence, as if an earthquake had shaken it.

At that moment it seemed as if the end of the world, long in abeyance, had come to extinguish, not only the feeble sparks of life which still remained, but the globed earth itself. A large section of the carved and glowing roof cracked and rumbled overhead. Fire showed at its edges, and then with a mighty splash the great dome broke loose and hurled itself into the boiling depths of the dwindling lake.

The water sputtered. There was a burst of hot steam which filled the cavern. Overhead the fire demons roared and howled. The casque of translucent stone which had confined them had fallen, setting them free.

CHAPTER XV

Tellus Again

ALLUS MARCE, with the eighty-nine men of his crew, had brought the new space-car safely aground at the edge of the valley which had once been the bottom of the sea. Like an uncanny demon of brilliant metal, the ship rested on the edge of the sandy desert which stretched away endlessly, hard and dry and glittering with crystal.

The vast plain was nearly level, except for the depression of the valley. Its curved and gentle surfaces rolled away to the west and north in a series of rounded, sandy hills; and in the blue distance was a chain of mountainous, jagged ridges.

It was the valley that interested Allus Marce and his men, however. They lost no time in going into it. Posting only a small guard, they quickly adjusted themselves to the conditions of weight and atmosphere on Tellus by their gravity nullifying equipment. Then the party moved slowly down to the lowest level of the valley, keeping close together and watching carefully for any sign which might indicate that life still existed.

Straight to the milky shaft at the valley's lowest point they flew. There Allus Marce paused to examine with surprise and delight the statue which he saw had been replaced by human hands since his earlier departure.

"We will now learn," he declared, "whether our trip has been in vain. For when I move this mechanical thumb, as if to take away the message it once gripped, it should set in motion the machinery which will open the tower to us."

"But if it does not move?" asked a lieutenant.

"Then," replied Allus Marce, "we will know that it is time for us to return to the suffering moons of Jupiter without the aid we have come so far to seek, and to lead our people as well as we can to their own destiny. If the statue does not move then the race of Tellurians is extinct and we have only wasted time in coming here."

"Then I pray you, Commander, move the thumb!" cried an impatient member of the crew. "This strange, dead world depresses all of us. We are somehow afraid, in this magnificent whiteness. On this earth there is too much quietness and tragedy."

Allus Marce extended a trembling hand. His fingers grasped the mechanical thumb. At that moment the sad smile of the ebony figure seemed to pierce his very soul. It seemed almost as if the figure were about to speak. He paused a moment nervously, half expecting to hear some sound from the stony lips.

With sudden resolution he moved the thumb aside. He grasped the arm and wrenched it as if he were forcibly removing the cylinder. The thumb snapped back in place. The assembled men from Jupiter drew off a little, awaiting what might happen.

But there was nothing. The figure only bent on them its unscrutable, compassionate smile, its understanding eyes. It did not turn or sigh or plunge through the tower. No trapdoor came to view. And even though they shook it, pried against it, and tried to remove it bodily from the sloping roof of the giant milky crystal, they could not make it yield or give them access to the stairway in the tower.

After an hour or so of labor, Allus Marce gave up. "They are gone," he said quietly, with a strange sadness in his voice. "We are too late."

The others prepared to return to the space-ship. Standing upon the edges of the tall monument which human hands had erected here in the last stronghold of a forgotten race, they seemed like beautiful, eerie birds, poised for flight. They had re-discovered the dead planet, Tellus, and had found it, to their regret, uninhabited and forever uninhabitable. Now they were ready to return.

But in that instant, as Allus Marce stood with his fellows poised for flight to the space-car which would bear them home again, he had a strange premonition.

Standing back, he gazed with keen eyes up and down the valley's crumbling walls. His vision caught the deep wound in the side of the eastern mountain, and even as he glanced at it he perceived a tiny wisp, a haze perhaps, lingering over the quarry. For a moment only he stood there, staring at it. Then, spreading his powerful wings, he was off to investigate this phenomenon.

The others followed him. Quickly they moved the jagged rocks aside, exposing the old hole which led into the cavern underneath. Out of it was coming the haze which attracted Allus Marce's eye. Down inside they could hear,

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Professor Diel's RAY

by Frank Brueckel, Jr.

(*Illustration by Paul*)

A scorching wave of heat came from the plate and struck me, where I was standing before the machine. I uttered a cry of agony and staggered.

MY physics teacher, Professor Diel, was not the kind of man who relishes company, and when not in class, was a very quiet, unobtrusive person. So I was rather surprised, one day, to find that he had come out of his shell and sent me a polite invitation to visit him. But then I was a sort of favorite with the professor, from the first day we had met in his physics class, probably because I, too, was a sort of retiring individual.

"Good evening, Ned," the savant greeted me, as I opened the door of his little cottage.

"Good evening, Professor."

"Come into the laboratory, Becker —I have something interesting to show you."

He led the way to his laboratory, a single room which comprised half the house. It was equipped with the usual array of retorts, mortars, crucibles, test tubes, chemicals, and various engines and motors. At one wall stood a frame of wood with canvas draped over it. Toward this the sage led me in silence.

Arriving, he undraped the canvas covering, and we looked upon a rather complicated mass of machinery.

"My boy," said the scientist, as we gazed at the machine, "you are the first person to whom I have shown this instrument. You know that I am rather sensitive and that ridicule of any of my ideas tends to discourage me from my intentions. Therefore I tell no one of my theories until I have proved them to my own satisfaction. But I called you today because I know you will not laugh at me, and because your alert young mind can be of valuable service to me in perfecting my invention."

I murmured something about being highly honored, and looked again at the machine. It was a large cylinder-like object of eight feet in diameter and four feet deep set on its side against the wall, with a shining, greyish metal-like front; a sort of radio-like affair set on a small table across the large room and a square metal plate eight feet on edge set up against the wall on the other side of the radio, with a sort of projector or arc-lamp on the right of it. From these parts ran wires to several large batteries standing beneath the radio-table.

From a small stool near-by the professor picked up a magazine, turned the pages and came toward me.

"Becker," he said, "do you ever read this magazine?" He held up the book and I recognized it as one which specialized in a certain type of scientific detective stories.

FRANK J. BRUECKEL, JR.

"I've seen one or two copies somewhere, sir, but I never read it," I replied wondering if the book had any connection with his invention. I wondered, too, how he had come to read the magazine, for I could not see how he found the leisure to concern himself with anything not strictly scientific. Holding up the page to which he had turned, the professor showed me the title of a story I had once read before, merely for the sake of entertainment, which told of some detective capturing a master-crook by means of inventions which were, to my way of thinking, altogether outside the range of possibility.

"In this story," began the savant, "a certain scientific detective invents an instrument with which to track down a notorious crook. This instrument—purely fictitious, you know—has the power to send its visual-auditory beam through stone walls, reveal any scene beyond, and convey every whisper to the person handling the machine. And my boy—" he almost shouted, "I have constructed this machine! I have made it an actuality!

"It is true, my instrument cannot carry sound as yet, and I do not know what the visual results will be, but I have the correct fundamentals, and its perfection is merely a matter of detail."

IF someone had come along fifty years ago and told you that you could look into the human body and see some of the organs as well as some of the bones, or if someone had told you that you could sit in your home and receive music from all over the world without a single connecting wire, he probably would have received rough treatment.

Understanding of wave motion and its effects is as yet in its barest infancy. We know so little about the subject and its various applications that we might truly say that the surface has as yet not been scratched.

We know that tremendous amounts of power can be sent through the "ether waves." This becomes painfully evident on a hot day when we realize that the electromagnetic waves originate in the sun some 92,000,000 miles distant.

The present author has considered some aspects of electromagnetic waves or rays, and there is nothing contained in this story that will not sound commonplace one hundred years from now.

It is all good science, and, at the same time a surprisingly new use is found for Professor Diel's ray.

His meaning did not sink into my understanding for a second or so; when it did, I weakly sat down on the stool and regarded the professor in open-mouthed awe. I was dumbfounded.

"What!" I cried, after I had regained my senses enough to enable me to articulate, "do you mean this machine has a ray which can pierce stone walls and reveal anything taking place behind them?"

Professor Diel began to rub his hands.

"Exactly, my boy, exactly!"

"What — where —

how?" I demanded.

"By a very simple expedient."

"It must be miraculous!"

"Oh, there isn't anything really remarkable about it. You see this projector? From it emanates the Cosmic Ray discovered several years ago by Dr. Millikan. These waves, you know, are the most powerful known to science, and can easily penetrate even metals having an extremely great atomic density. This plate on the side of the projector forwards these rays into space, the beam having an eight-foot edge—the size of the plate.

"It is a well-known fact that the Millikan ray has electromagnetic properties just like light; so first I send out a magnetic beam from this radio, to guide the Millikan ray."

The professor indicated the radio-like instrument, and taking off the cover, we looked within. Its principal contents were radio parts, to which was added a great electromagnet. From its one pole a wire ran to the Cosmic Ray forwarding plate, and from the opposite pole a cable ran to the "box" at the left.

On the front, outside, were three dials, the one at the left reading "Thousands of miles," and running to 13; the middle read "Miles," and ran to 1,000; the one on the right read "Feet," and went to 5,280.

"At any point I may desire," my companion went on, "the waves are curved back again, and return to the machine, where they enter this cabinet—" he pointed to the "box"—"and are lengthened till they become light waves perceptible to the human eye. Then they are seen on this selenium plate."

He pointed to the shining, grey metal front of the cylinder-like affair.

An Unfortunate Experiment

"SHALL we see how the instrument works?" he asked, his eyes shining with anticipation.

I was by this time as excited over the prospect as himself, and urged him to do so.

He threw a switch on the radio, and turned the middle of the three dials, stopping at the number 100.

"The electro-magnetic guide beam capitulates now at a distance of one hundred miles from this point. We will now turn on the Cosmic Rays and see what we can see."

He pushed a switch on the projector and waited a while. Then he moved to the cabinet, and close to the wall, pressed a button. A foot out from the wall he pressed another button, another foot and another button, and then he placed his finger on the last button.

"Perhaps you wonder what these buttons have to do?" he asked me. I nodded.

"Well—when I touched that button closest to the wall, the incoming Cosmic Rays were given the wave-length of the Gamma rays of radium—the second button gave them the wave-length of X-Rays, the third button makes them the nearer ultra-violet rays, and this button should make them light waves which we can see. The Millikan rays have been lengthened in these successive steps."

"Simple, eh?" he asked, as an afterthought.

"Sounds so," I replied.

The savant pushed the last button on the "box," and we looked breathlessly upon the selenium plate. A vivid white glare burst upon our vision and thoroughly illuminated the interior of the semi-dark chamber. But we could see nothing on the screen—no object of definite form—just that white, blinding glare. With a murmured exclamation of disappointment Professor Diel moved to the radio and drew a lever along a metal semi-circle, watching the screen as he did so. Swiftly the white glare turned to violet, indigo, blue, green, yellow, orange, red, and suddenly died out; but a scorching wave of heat came from the plate and struck me where I was standing before the machine.

I uttered a cry of agony and the professor shut off the machine and leaped toward me as I staggered a few steps, tottered, and would have collapsed had he not caught me.

It seemed to me I was on fire—my brain burned; in a mirror I caught a glimpse of myself—my lips were black, parched, and bleeding; my hair was shrivelled and singed; my skin cracked and fiery.

Weakly my tortured mind sought an explanation while the savant laid me on a lounge. Despite my hurts my mind fastened itself—fascinated—on what I had seen. What had happened? Presently I came to the answer. When the Cosmic Rays had passed below the scale of red light they had become infra-red waves—the Heat Ray—and this Heat wave had struck me with such terrible power.

I was thankful that the ray had not been more intense—had it been, I would have been reduced to a charred, formless corpse in that fraction of a second.

Then my weakness overcame me, and I lost consciousness.

An Alert Young Mind

IT was two months before I could again see my teacher at his home. He was profoundly sorry that I had suffered so much on his account, and had called on me nearly every day while I was recuperating at the hospital, to express his dismay and contrition, and his hope for my speedy recovery.

And at last I stood before him again in his laboratory, looking over the machine.

"Have you been working on it lately?" I inquired.

"Yes, but—" the scientist shook his head despairingly, "I can't make anything of it. Every time I send out my beam the selenium plate registers only the same things—any one of the prismatic colors, or, if I move this wave-lengthening lever, all the colors of the spectrum. Not once have I had the slightest shadow of an outline on the screen."

He sat down on a bench and regarded the silent machine with eyes of hurt pride and shattered hope.

I seated myself beside him and placed an arm about his shoulders.

"Never mind, Professor, we'll get it yet," I encouraged him.

"We?"

"Yes—we! I'll help you as much as I possibly can."

The professor's eyes were moist as he patted my hand. "Thanks, my boy, thanks!" he said, for it seemed he knew nothing else to say. For a "cold-blooded" scientist he was exhibiting a surprising amount of sentiment.

"Now, let's take this thing practically once," said I, for I remembered what the professor had at first said about my "alert young mind," and I was eager for an opportunity to display my knowledge—or my ignorance.

"First of all," I began, "this idea of turning the Cosmic Rays into light waves after they have come back to this starting point is wrong. The waves in their natural state pass clear through the objects we want to see, and that is why we can't see them. So we must change the Millikan rays to light rays at the point where they bend back to the machine. But there we're stuck. If the scene we wish to witness is in a building, the light waves cannot penetrate the solid walls."

The professor nodded gloomily. He said nothing—apparently he was glad to have someone else do his thinking for him.

"But I believe," I went on after a moment's silence, "that there was discovered some time ago a ray that could project a picture through a brick wall, the ray meanwhile remaining invisible until intercepted by a fluorescent screen."

"I thought of a fluorescent screen before, but I wanted some screen that would produce as near as possible the natural color effect. Still, that is better than nothing, and I think I'll try it. I am glad you mentioned it, my boy."

"May I make another suggestion?" I wanted to know.

"Certainly! I would very much appreciate it."

"I understand that the ray, when coming back, makes a horseshoe turn. Now, I think that is wrong, for the ray will not show surface features that way. Assuming that the fluorescent screen will work, the ray will enter an object from the rear, pass through, and continue again, and the most we will be able to see is a sort of a silhouette effect. I hope I have put my meaning clearly enough."

"I know what you mean—so you suggest—?"

"That you find a way of turning the beam at a sharp angle, and make it a matter of *re*flection rather than *de*flection."

"I wasn't wrong when I said your alert young mind might be of valuable service to me! We'll get it now!" exclaimed the scientist, seizing my arm and pumping it vigorously.

He seated himself at his table, seized a piece of paper and a pencil and feverishly dived into his work. I reasoned he could work better by himself, so I picked up my hat and moved quietly to the door.

"Good-bye, Professor."

"Good-bye, Ned, my boy," he called back, "come again tomorrow if you can make it."

But it was some four days ere I again saw the professor and his wonderful machine. I saw at once, as I entered the laboratory that several changes were made on the instrument. A fluorescent screen took the place of the selenium plate, and on the top of the "radio" box was an iron rod, set horizontally, with several wires running along its length.

"Let's see how she works now," said the scientist, after the salutations. He started the Cosmic Rays outward, following the magnetic beam, then he pulled a switch on the horizontal rod. "This switch causes the beam to be suddenly turned back, as you suggested," the savant explained. Next he pressed a button at the base of the rod's vertical support, and turned again to me.

"This button," explained the professor, "is for the purpose of lengthening the Millikan rays to a point where any obstruction will impede their progress sufficiently to enable us to make out shapes. Where there are no obstructions the waves will be unimpeded and will show no figures on the screen."

He moved to the screen and threw the switch. And then we saw an amazing thing—dim, shadow-like against the grey-green fluorescent plate, a picture formed—a little area of level field with a few shadowy trees upon it, and two or three moving blotches.

Professor Diel moved to the radio and pulled the lever along its semi-circle. The tone of the picture turned to violet, and we were able to distinguish a few more details than at first. The moving, irregular blotches we assumed to be cows.

At best, the picture was broken and imperfect, it is true, but nevertheless, the professor and I saw Success standing within our reach. At sight of the picture, imperfect as it was, the grey-haired professor emitted a boyish whoop that would have done credit to younger lungs than his, grabbed my hand and capered about the room as one seized with dementia. A most undignified demonstration, truly.

What the Ray Found

"WE'VE got it, my boy! We've got it!"

To be frank, I believe I puffed out my chest a little when his "We" struck my ears.

"Well, Professor, may I make another suggestion? Couldn't you find some way of lengthening the Cosmic Rays in various proportions out where the beam is turned back to the machine? For instance, if they struck a red object and a blue one, couldn't those striking the red one be made longer than those striking the blue?"

"I'll see, my boy, I'll see what we can do!" he replied.

The next day I called again, and again the scien-

tist and I stood before the machine. I saw the selenium plate had been reinstalled at the front of the cabinet.

"Suppose we investigate the interior of the new bank at Sheffield?" suggested Professor Diel.

"Fine!"

He threw the switch on the radio (the savant had no particular name for the machine, and I could think of none), and turned the middle dial to 5.

"Five miles," said the sage.

He threw the switch on the Cosmic Ray projector, waited a second, and pressed the button at the base of the horizontal rod atop the radio. Then he moved to the cabinet and pushed the switch down.

Upon the screen flashed a picture—clear cut and beautiful, of the new bank in the town, seen from the east side. The professor slowly turned another dial on the radio, and slowly the picture advanced—the white brick wall came close—a blur—and the inside of the bank was on the screen. To our left were the tellers' windows, deserted—upon the floor lay half a dozen people, sprawled out as though dead. And moving through a barely perceptible white haze were five men with gas masks. One of them carried a sort of spraying machine, another peered out of the windows with an automatic rifle in his hands, a third entered the tellers' compartment, and two others knelt before the great vault door with an oxy-acetylene torch. Presently one of the last named turned off the flame, his companion grasped an iron bar, and together they slowly pried open the ponderous door. Then they disappeared within the vault.

Five minutes passed.

The five bandits were together—the gas-sprayer and the blow-torch disappeared in two grips, two other bags received the money. The man with the rifle thrust the weapon down his right trouser leg, and the five marched out of the bank, doffing their gas masks as they did so. Outside a car awaited them, they dumped the bags therein, climbed in themselves, and sped away. And all this in broad daylight!

When we had witnessed the first scenes of the robbery, the professor and I had been too astounded even to think, but my teacher had quickly recovered himself, followed the robbers out of the bank into the car, and now went along with them through town to a country road—all this with his ray, of course.

"Thornhill road," the professor told me, referring to the road now followed by the bandits. While he kept beside them with the ray, I quickly wrote out a description of each man, noted the road they were taking, the make of car, and managed to get the license number.

Finally the car halted, the five bandits emerged and entered a great, ruined building—rusty, torn cables hung from the tottering brick walls—a hundred chasms and passages and doors opened on every hand. Both Professor Diel and myself recognized the ruined structure as the old glass factory at Thornhill. The robbers threaded their way through the tortuous mazes of the massive pile down to a little, damp room far below the ground floor. Here were a table and a bench, with a few blankets rolled up on the latter.

Depositing their burdens on the floor, the bandits unpacked the grips that contained the stolen money, and, grouping themselves about the table, they proceeded to count it. A hundred thousand dollars there was, and this was divided equally among the five. Apparently well pleased with the result of their haul, they produced a quart of liquor, and imbibed several drinks. It seemed that they had not slept the preceding night, and now, tired and drunk, it was not long before four of them had unrolled their blankets and crept in to sleep, a drowsy fifth man left on guard, who idly fingered his revolver.

The professor moved to the telephone and called up the police station.

"Hello, Chief! This is Diel. You know all about the bank robbery by now, of course? . . . Well . . . Beg pardon? . . . Oh! Well, I can give you information as to where you can find the scoundrels . . Eh? . . . Yes! They are in the Thornhill glass factory. Way down—I can't describe the path. What? Never mind how I know! Get them first—then I'll show you. Good bye!"

For an hour we watched the little room where the bank robbers slept. The guard looked drowsy. He settled himself more comfortably against the wall, his lids drooped, and he fell asleep.

A shadow darkened the doorway of the little chamber—the guard was suddenly wide awake, grabbed his gun, but already a blue-clad officer had leaped upon him, a dozen others at his heels. In two minutes the thugs, with their official escort, marched out of the room, up the galleries and stairs, out into the sunlight, and rode back to Sheffield and jail.

That evening, before Chief Halley of the police; Mr. Arnold, president of the bank, and a dozen scientists of the university where he taught, the professor explained his machine, as he had explained it to me. He insisted on having me stand beside him during the short lecture, and called a good deal of attention to the fact that much of the machine's success was due to the "brilliant mentality" of his esteemed young "colleague."

After the lecture, which was accompanied by practical demonstrations, the chief of police tendered the savant the $5,000 reward that had been put up as soon as it was learned that $100,000 had been taken. The professor accepted it with many thanks, and said he would devote the money to the furtherance of scientific research. He wanted to give me half, but I declined, saying there was another, more precious, reward he could help me win.

While you may have wondered as to my scientific zeal in helping the man, you see, he has a daughter!

THE END

Before The Asteroids

(*Continued from Page* 891)

planet Mars was snuffed out with the coming of the "great cold" is clearly evidenced by the last of the "thought books" to be enclosed with the machines which make them intelligible to us today. It was likewise proved by the condition of the fossil remains unearthed by the two scientists, Moody and Bedworth, and now on view in the International Museum atop the transoceanic air stage in Washington. That such life has never since inhabited the planet is ascribed to the scarcity of water. Knowing, as we now do, that the sea is the mother of all life, it is easy to understand that there would be little opportunity for a new form of life to originate after the great cold, since no seas exist.

To those who are interested in the family life of the people of Arin during the days of Ronal and Ila, it is recommended that Moody's latest book be examined from cover to cover. It is not to be supposed that the average reader will care to wade through the lengthy technical wording; but there are many illustrations of the finest sort that picture clearly the remains of household articles, the moving ways of the cities, close-ups of the great canals, and other scenes of interest pictured exactly as found by those two daring scientists. These illustrations are reproductions of photographs taken during their stay on the dead planet and serve to show many phases of the lives of those ancients who looked, lived, loved and acted much as we do today, but who were so greatly in advance of us in scientific attainment.

On a clear night, when Mars is close to Earth, you might take a trip to one of the large observatories and beg for a peep through its modern super-telescope. If you are so fortunate as to obtain a good view, you will see for yourself many of the broad canals that cover the surface, and may even distinguish the ruins of La-dar beside the canal which our astronomers have called Pierius.

Or, if of venturesome disposition, you might even consider the offer of Bedworth recently made through our own news broadcasts. He and Moody, it will be remembered, have obtained the necessary financial backing and started the construction of a spherical space flier similar to those of the people of Voris. This vessel is now completed, and they will allow fifty able-bodied Americans to accompany them on a three-year trip to Mars. This is undoubtedly a wonderful chance; and there may be some of you who are sufficiently interested to take advantage of the offer and thereby embark on a glorious adventure.

The author, however, is inclined to prefer the "thought books" as a source of entertainment and information. Possibly a bit of the cautious nature of old Torveg has been passed along through the medium of those slender wires. At any rate, even amidst the wonders of America in 1980, we, too, are doubtful of the high state of perfection of some of these "new-fangled" inventions—at least to such a degree that we have no desire to make the long voyage to Arin.

THE END.

The Mystery Metal

(*Continued from Page* 901)

No reason for his act can be given. Mr. Kay is a scientist, and has recently been experimenting on the cathode ray."

"That is interesting," I said; "but why do you attach so much importance to it? The fact that he was interested in the cathode ray is relevant; but may he not be doing so harmlessly?"

"I knew John Kay at the Lakewood Scientific Club several years ago," said Dr. Lester. "He was always very despondent; moreover, he was soured on humanity at large—the result of misplaced confidence. Do you realize, Jack, that this is not only a confirmation of my theory, but also a hint at the motive? He attempted suicide; was soured on humanity; it all led to insanity—hence his diabolical acts. Merely the doings of a madman; a man really to be pitied!"

"You are quite a detective, Dan, as well as a scientist!" I gasped in amazement.

"When desperate, a man can do and think of many things, Jack," said Dr. Lester, solemnly. "It was not merely the solution of a great civic problem I was working on; it was vengeance: vengeance for the blood of my brother." His face betrayed the painful memories; but for only a moment. Suddenly he grabbed the two suits, which he had brought from the secret laboratory, procured a third one from his desk, and snatched his hat from the costumer. "Come, let's go. Chief Dennison will be waiting for us. And, you, Jack—I may need your assistance; you know how the ray works, whether you understand it or not."

Retribution

CHIEF Dennison was waiting for us. In a few words, Dr. Lester explained how the ray worked and the necessity for wearing these special suits. In a moment we were dressed for the occasion and at the door of 332 Grosvenor Place. It was an old, time worn building, eight stories high, covered comparatively recently with a coat of stucco which had already become dusty, and was breaking off in places, revealing crumbling brick, The Chief was going to ring; but Dr. Lester stopped him.

"We must take Mr. Kay by surprise," he said. "That is the only safe way; and it's none too safe."

He pushed the door open; and cautiously we mounted the old creaky stairs at the right. Seven staircases in a row; rather dilapidated, dusty, the banisters broken, and partly gone! The seventh floor seemed wholly deserted; the eighth almost so; yet down the dark corridor we could discern some signs of recent habitation: the transom of one room was open, and the door slightly ajar.

"That's where he lives," whispered Dr. Lester. "Careful, now. Get your gun, Chief. And Jack, you stay close by me."

He swung open the door. Before us was a shabby living room, poorly furnished. On a table were a few dusty books, a pair of chemist's balances, and a few vials. A few old chairs, a trunk, an old cot, which gave no evidence of having been slept in the previous night, and some shelves with dishes and toilet articles comprised the other furnishings of the room.

"Gone!" said Dennison, in dismay.

"No, not gone!" Dr. Lester interposed. "His laboratory is somewhere near, and that's where we'll find him. Perhaps a secret door or—."

He started looking around the room, quietly moving the meager furniture. The Chief and I followed suit. Somehow I stepped behind the trunk; there was a click; and a door in the side wall, perfectly concealed, swung open. The Chief whirled around, covering the door with his gun; and Dr. Lester and I were before it in a moment. My friend gave a cry of joy; for there, in the center of a room, revealed by the door, was an instrument similar to the one in his own laboratory; yet larger, and with several additional dials and knobs. The walls of the room were lined with the same silvery metal that our suits were made of. On the lower part of the walls, the metal was put on in panels. *One panel was missing, and the instrument of death was focused directly on that spot!* A glance indicated however that a time switch operating it had shut off the power.

"That is the diabolical mechanism," Dr. Lester said, pointing it out to the chief. "It looks harmless enough, but that is because you've never seen it in action. See how peculiar the cathodes are. That's the secret of the tremendous power. You will notice that the cathodes are not alike. That is what makes the twin tubes of value and makes it possible to focus the rays with such accuracy."

"But where's Kay?" demanded the Chief.

I had taken a few steps toward the apparatus, when, in the semi-darkness of the room, I stumbled over something. Chief Dennison threw his flashlight in that direction, revealing the prostrate form of a man. He was stone dead. His body was covered with a suit similar to ours; but the mask had been jerked off, revealing a face, which, though calm, was weird in aspect: the countenance of a maniac. Dr. Lester bent over him.

"This is Kay, but not the John Kay I used to know," he said, sympathetically. "He has changed so, poor mad creature! And what a pity that such genius should be so misdirected! But his mischief is at an end. He must have put on the switch accidentally and come in front of the ray. Like Frankenstein, he has become a victim of his own creation."

THE END

A Rescue From Jupiter

(*Continued from Page 925*)

faintly, the roar of the disintegrating waters, the rumble of earthquake and chemical fire, and mingled with all these other sounds certain faint human cries which caused their hearts to leap.

Allus Marce was the first man through the opening. The others followed, rushing after him into the cavern. There they saw in an instant what the shock of the space-car's landing had done. Most of the roof of the cavern, with its cold, bubbling fire, had fallen into the puny lake, all but smothering it. Upon the pallet which Nina had made for him, the old man still lay, though life was almost gone. Only in his dimming eyes did consciousness struggle. The remaining fire in the cavern's dome lighted up the scene with lurid brilliance as the clouds of steam and vapor, pouring from the smothered waters, drifted like wraiths through the hot atmosphere.

Nina was kneeling over her father, holding a cup of water to his lips, trying to speak softly and reassuringly, yet distraught herself by the cataclysmic end of the cavern's roof and the burning lake. Her back was toward the opening through which the Jovians had entered. She did not see the approach of her rescuers until she heard the soft syllables of their speech. Turning, she seemed to recognize them, and involuntarily uttered a sharp cry of alarm and hysteria.

Nina and Marce

ALLUS MARCE, glancing at her with admiration, came up and knelt at her feet.

"Perhaps you are—Nina," declared the heir to the House of Allus, remembering the language of the Earth-people. "We are from the planet you call Jupiter. We—have come to rescue you."

Nina passed a weary, trembling hand across her eyes. She had a mad moment of delirium, believing that she was again experiencing a dream.

But the old man on the pallet, arousing himself from stupor for a moment, beheld the Jovians also and half arose from his bed, his eyes staring wildly, his long, disheveled hair falling over his withered face.

"Nina—Nina!" he said in a voice both of wonder and alarm. "Do you see them, the winged men you dreamed about?"

"You too?" she cried. The water bowl clattered on the pebbles at her feet. She held her outstretched hands toward Allus Marce, touching him as if to convince herself that he was real. He stood up at her first words.

"Forgive us for welcoming you so crudely," she exclaimed. "We do not know even yet whether we are dreaming. We have been locked in this hole for so long—it is small wonder if we have gone a trifle mad."

"Indeed, we are real," replied Allus Marce quietly. "Outside we have a space-car which will carry both of you far from this planet. It is my honor to welcome you to Neina, largest, noblest moon of Jupiter, where you may live with us as persons of the highest rank. Your message, taken from Tellus many months ago, has been received and translated there. We know your history."

"But—we are black, and you are white. Does color make any difference to you?"

"On the contrary. Besides our light will make you white as we are as soon as you have been exposed to it."

"We have nothing with which to repay your kindness."

"We do not ask for pay. Your beauty and gracious presence, and your wisdom in the arts and sciences which we lack in Jupiter and her satellites—these will more than repay us, daughter of Tellus."

Allus Marce saw that the old man was very weak and in immediate need of medical attention. He ordered the physicians of the party to minister to him at once.

"Let us go out into the open air," he said to Nina. "There we can talk with greater ease of Jupiter and the worlds that you shall see."

He perceived that her eyes had consented. Placing his strong arm about her waist, he carried her up through the opening. In a few minutes they were walking on the valley floor, now bathed in shadows.

"My people will be overjoyed at your safety," Allus Marce continued. "For I would have you know that a mighty civil war impends, in which the four satellites seek independence from the oppressions of the rulers on Jupiter. You and your father could aid us in that struggle, in many ways."

"But my father is very old. For weeks I have been expecting his death. I'm afraid he cannot live much longer."

"We have medicines and treatments which will restore him forthwith to health, for he is suffering mostly from exhaustion and exposure. And you, Nina, shall be invested with all the powers of a princess of the land. You shall unite our people to wage common battle against the enemy. You and your father, with your superior knowledge of the science of warfare, shall be of the utmost aid in winning for us our independence."

"I, too, am a lover of peace," he explained gently. "So also are our people, the men of the satellites. But we have been cowardly too long; we have resisted too little, and now we must fight or give up everything. Will you not aid us to independence when slavery is the only alternative?"

"We have seen so much of war," she replied. "We have seen the race of men on earth engaged in mad contests of self-destruction until death was loosed upon them all. Is it true that there is no peace anywhere in the universe?"

"Struggle and death are the natural accompaniments of life, wherever it is found," the young man explained.

They walked in silence for a short way, and then Allus Marce turned and faced her squarely, taking her shoulders in his strong hands.

"Nina," he said abruptly, "you needed us, and sent a message to us. My people, out of the goodness of their hearts, have raised and financed this expedition to rescue you. We do not ask anything in return for that rescue. We are not here to bargain with you but to offer you life and ease and plenty. But my people also need you. Will you help us?"

"Yes," she said at length. "However we can help you, we will."

Later she stood on the edge of the cliff and stared down into the dry valley which held the crumbling remains of Manseche. "Henceforth," she said, "until a way to restore the Earth is found, the people of the Moons of Jupiter shall be my people, and their needs my needs—if they will accept me as you have accepted me!"

"Then come," said Allus Marce, taking her into his arms and rising straightway toward the entrance to the space-car. "Your father is already here and ready, and we are now about to depart. We have no time to lose!"

* * * * *

A little later Nina stood beside Allus Marce at a window of the space-car. Below them, already far away, a great yellow disc was spread out in the sky. Upon it in high relief were the dark and ragged patches of land which had once been continents. The seas were still marked by tremendous glittering fields of salt, reflecting the sun's light, even at that distance, with blinding brilliance.

"There," said Nina a little sadly, pointing downward at the disc, "I have lost the Earth!"

Allus Marce held her close to him.

"By that stroke," he replied seriously, "the Moons of Pleida have gained a Queen!"

THE END.

The Insatiable Entity

(*Continued from Page 909*)

and around to the big garage where I had left my old car.

As I twisted the key and pressed the starter button, the doctor and professor were one on each side of the car, both uttering the merest drivel, and entreating me to remain. The motor did not start at first and I was forced to listen to facts such as the extinction of the beast with concentrated sulphuric acid and inconsequential myths regarding my part in future experiments with the beast. I said not a word—what would be the use?

I merely shook my head.

Finally the motor fired, sputtered and took hold. I shifted the lever to second speed, stepped on the throttle, and took my foot off the clutch. The doctor and his friend were sent sprawling, but I was free! I have never again been within fifty miles of the place.

THE END.

What Is Your Knowledge of Science?

Test Yourself by this Questionnaire

1—What happens to radium during a period of 2500 years? (Page 899).
2—What are the asteroids, and what is their relation to the other planets? (Page 871).
3—How many earth days are there in the Martian year? (Page 872).
4—What effect has the atmosphere of a planet on the body it surrounds? (Page 880).
5—What is the origin of the "Cosmic Rays?" (Page 915).
6—What are the proportions of nitrogen and oxygen in the atmosphere? (Page 920).
7—What is the penetrating power of the "Cosmic Rays?" (Page 902).
8—What is the similarity between light waves, radio waves, and electricity? (Page 903).
9—What is the length of X-Ray waves? (Page 903).
10—What is the simplest form of animal life? (Page 903).

Science News of the Month

ASTRONOMY—METEOROLOGY

SHAPLEY LISTS MYSTERIES OF SKIES

Professor Harlow Shapley, director of the Harvard Observatory, has listed the ten mysteries of the universe which are still to be solved. The most important question is: "Is the universe running down?" By this, Dr. Shapley means: "Is it progressing to a heatless death?"

The other mysteries are the cause of the perplexing oscillations of the earth; the location of the original home of the planets; the reason for the rapid rotation of the sun (which may have been caused by the influence of another star), the source of energy of the universe (which may be explained, in part, by radiation); the past history of dust meteors; the problem of the dwarf stars (2000 times as dense as lead, and so dim that only those can be seen which are near to the sun); the nucleus of our galaxy (The Milky Way); the apparent recession of outside galaxies at a terrific rate of speed (the question to be determined is whether the motion is real or the effect of relativity); and the question of whether we have reached the outermost exploratory limits of the universe.

Several of the questions, according to Dr. Shapley, can be answered by the use of the new telescopes under construction. Others can perhaps be solved by mathematics, with the application of the laws of gravity and the measurement of star differentials.

3000 DEGREE "SLEET STORM" WILL MAKE LARGEST TELESCOPE POSSIBLE

"Sleet storms" at 3000 degrees Fahrenheit in which a layer of clear transparent quartz is coated on a base of white quartz by an oxy-hydrogen blowpipe, in much the same way that a clear layer of ice is sometimes coated on trees in a rainstorm in cold weather, may make possible the new 200-inch telescope, planned for the California Institute of Technology. Dr. Elihu Thomson, director of the General Electric Company's research laboratory at Lynn, Mass., told of his researches on methods of making the huge mirror. This mirror, 200 inches or sixteen and two-thirds feet in diameter, will be the heart of the telescope. It will be twice the diameter of the largest telescope mirror ever made before.

Unlike the ordinary small telescope, the new instrument will be a reflector, in which a dish-shaped mirror concentrates the rays of light from a distant star into a point on the photographic plate or in the eyepiece through which the astronomer looks. The final curve of the mirror must be ground very carefully; so that it will have exactly the right shape, and give a sharp image.

Glass, the most popular material for telescope mirrors at present, has some disadvantages, pointed out Dr. Thomson. Changes in temperature produce a considerable change in the size of the glass. And when the telescops is in use, slight changes of temperture produce considerable changes in the image seen in the instrument. "Therefore it is not glass that we shall use, but fused silica, or melted quartz, melted in an electric furnace at between 1700 degrees and 1800 degrees Centigrade, which means more than 3000 degrees Fahrenheit, or about the melting point of platinum."

HUGE INSTRUMENT TO REVEAL STAR SIZES

The newest and one of the largest of the instruments of the Mt. Wilson Observatory will soon reveal the diameters of a number of stars. The fifty-foot interferometer is its name, and it has been under construction for nearly eight years. It is based on the same principle as the 20-foot interferometer designed by Prof. A. A. Michelson, and used as an attachment to the great 100-inch reflecting telescope first to measure the diameter of a star—Betelgeuse.

In the new instrument is a beam 50 feet long with a flat mirror at each end, which reflects the light from the star to the center of the beam. Two additional mirrors then reflect the light to a concave mirror which brings the light rays to a focus. The waves in the two beams "interfere" with each other, producing a series of bands, instead of a sharp point of light. By sliding the outer mirrors along the beam, a position is reached when the bands disappear. From the distance between the two mirrors when this happens, the apparent diameter of the star, or the angle that lines from its two sides would make at the earth, can be calculated. Knowing this and the distance of the star, its diameter can be determined.

NEW COMET FOUND ON TEN-DAY-OLD PHOTOGRAPH

Discovery of a new comet, not in the sky, but on a ten-day-old photographic plate that he was filing, was the recent experience of E. R. Carpenter, of the Seward Observatory of the University of Arizona. The photograph was made of the sky in the constellation of Aries (the Ram) on November 2. This star group was then high in the southern sky about eight p. m. At the time, the new star was expected, so comet was not noticed. After Mr. Carpenter found its image on the plate, a further search was made for it in the sky, but the glare of the moon prevented its being seen. When discovered, it was very faint, of the 16th magnitude, and was moving to the southeast. However, it had a short tail, which is rather unusual for so faint a comet. If two more observations are made of it, astronomers will be able to calculate its path, and tell whether it is approaching or receding.

AVIATION

GODDARD'S ROCKET TO EXPLORE OUTER SPACE

R. L. Duffus, writing *The New York Times*, describes Professor Goddard's plans for exploring some of the mysteries of outer space. Goddard plans to use a rocket twelve feet long and a foot and a half in diameter, which will be shot from a sixty-foot steel tower at Camp Devens, Massachusetts.

The Goddard rocket is the first one known to make successful use of liquid fuel. The latest one is expected to go straight up for several miles, and to return to the vicinity from which it was sent. The important test of the flight is the ability of the rocket to return intact. One rocket was flown with a camera and barometer, and the delicate instruments were not injured in the descent to earth. There is every reason to believe that a rocket could he sent thousands of miles into space and return without injury to its equipment. It may be possible to send one to the moon, but according to the article, there would be no possibility of its returning to earth.

In its present form the Goddard rocket is a steel cylinder tapering toward the top and bearing a pointed cap. This cap is equipped with an automatic, easily-opened parachute. When the rocket returns to earth it will he retarded by the parachute in exact proportion to the density of the atmosphere it strikes.

The speed expected to be attained is 8,000 feet a second, or about 5500 miles an hour—a speed not only within the realm of possibility, but absolutely necessary for interplanetary exploration.

OPEL FORECASTS ROCKET PLANE

Fritz von Opel, the first man to fly a rocket plane, has predicted that at some time in the future a rocket plane will fly around the world in six hours. Nevertheless he says in an interview with Richard Montague in the *New York Evening World*, there is nothing astonishing in a speed of 4,000 miles an hour. The type of rocket used will be propelled by liquids, not by powder; and already liquid has replaced powder in the rocket plane with which von Opel expects to fly across the English Channel next summer.

The liquid rocket is superior to the powder variety in many ways. It can be operated continuously, for fifty or sixty hours, if necessary, and it has much more power.

PROPOSED AIRPLANES WILL DWARF GERMAN GIANT

Four seventy-two-ton airplanes, each providing for 206 passengers, with all accommodations, and a crew of 17, will be flying over the United States within a year, if a project announced by Dr. William Whitney Christmas is carried to a successful completion. Dr. Christmas, a pioneer in aviation design, is vice-president and general consultant of the General Development Company, which plans to build the monster planes. According to Dr. Christmas, the four planes will be completed by the end of 1930, and will he immediately placed in service on long distance cross-country routes. It is believed that the large size will give much greater safety, as well as more commodious accommodations, than the smaller cabin planes now in use. The planes will cost about $500,000 each. The preliminary plans are for monoplanes, each ship having a wing span of 262 feet.

COMPLETION OF R-100 GIVES BRITISH TWO LARGEST AIRSHIPS

With the completion of the rigid airship *R-100*, England now has the two largest airships in the world. Like the *R-101*, which has been in the air for about two months, the new ship has a capacity of 5,000,000 cubic feet, as compared with the 2,600,000 cubic feet of the *Los Angeles* and the 3,708,000 cubic feet of the *Graf Zeppelin*.

As in the case of the *Graf Zeppelin* and *Los Angeles*, the framework of the *R-100* is made from duralumin. That of the *R-101* is largely of stainless steel, said to he stronger, weight for weight, than duralumin. The *R-101's* framework is novel in one important respect, however; the girders are so attached that they can easily be removed or replaced. In other airships damage to a girder requires that it be completely cut out and a new piece riveted in. The *R-100* is equipped with six Rolls-Royce *Condor* engines, each of 650 horsepower. These are mounted in three gondolas, one forward and one aft in each gondola. One gondola is on each side, and the third farther aft in the ship's center line. In the *R-101*, five Beardmore *Tornado* Diesel engines of 585 horsepower each, provide the power. These are in separate gondolas, two on each side, and one in the center.

BIOLOGY—EVOLUTION

"MISSING LINK" REPORTED FOUND NEAR PEKIN

The reported discovery of an invaluable fossilized skeleton—or rather several such skeletons—has led some eminent scientists to the belief that the "missing link" has at last been found. The skeletons, found in a cave near Pekin by scientists representing the Rockefeller Foundation and the Geographical Survey of China, are estimated to be 1,000,000 years old—much older than the "Piltdown" man or the "Java Ape-man." Of paramount importance is the discovery of a perfect skull with the skeletons. This skull bears characteristics showing that, even at the beginning of the ice age, there existed men with the power of thinking, and who walked erect.

The "Pekin" man is now believed to be the direct ancestor of the human race, and other famous fossil finds have been relegated to positions of minor importance. Even the Neanderthal man and the Piltdown man have taken secondary positions. The importance of the Pekin discovery lies in the fact that the skull is perfect; whereas in the case of the ape man in Java, all that was recovered was a fragment of a skull, with three teeth and a thigh bone. In the case of the Piltdown man, there was simply a fragment of skull and a piece of jaw. The importance of the discovery of a complete skull, therefore, is hard to overestimate.

MAN NOT THE APE'S BROTHER

That man is descended directly from the ape, the theory of Darwin, is doubted by Dr. Henry Fairfield Osborn, director of the Museum of Natural History, in his article in the new scientific journal *Human Biology.* Whereas the ape made his home in the jungle, Dr. Osborn believes that man had his being in the open or partly wooded prairies. Here, in the constant struggle to keep alive, pitting his skill against that of swiftly moving animals, his development took place. His remote ancestors, the apes, however, had their home in the jungle where the necessity of procuring food and shelter involved so little energy that they failed to evolve either physically or mentally. The great difference in the human hand from that of the ape is also part of Dr. Osborn's reasons for his theory. Since man's hand is not built at all for tree climbing he must have been in an almost treeless area for a great many thousands of years.

PLANT'S OWN ELECTRICITY DETERMINES ITS GROWTH

All living things generate currents of electricity, minute but measurable, and this electricity is the force that influences their rate of growth and determines their form, Prof. E. J. Lund, of the University of Texas, told the Botanical Society of America.

The unit of electrical generation in the living plant or animal, just as in an electrical battery, is the "cell"—although the living cell is a vastly different thing from the electrician's cell. The voltage of each cell is added to that of the one in front of it (in the direction in which the tiny current is flowing) and its amount and intensity have great influence in the activities of the organism as a whole.

It has even been possible to find electrical currents in living trees. In the Douglas fir and the white fir the current has been shown to flow continuously upward in the outer layers of wood, and downward through the inner layer of bark.

EXPEDITION TO STUDY LIVING "STONE AGE" MEN

Natives of Australia who, in this age of high-powered civilization, still live literally like prehistoric men of the Old Stone Age, will be sought out for study by an expedition from the University of Pennsylvania Museum. The Australian tribes have many physical features similar to those of the Neanderthal race which inhabited Europe about 50,000 years ago; and it would seem that they have not advanced from that time to this. The Australian aborigines have no clothing, even in regions where the climate is far from tropical. They have no domestic animals, and raise no crops, but eat chiefly game and wild fruits and vegetables. They live in temporary huts which offer little protection from rain or cold, and have no knowledge of pottery or basket-making. Clubs and spears are their only weapons.

The fact that the Australian tribes do not use the bow and arrow, which is one of the most important inventions of early man, would seem to indicate that they must have emigrated from the mainland of Asia before the bow and arrow was known, hence in very remote antiquity. One puzzle which anthropologists have not solved is, why a people with such primitive economic standards should have an extraordinarily complex social system.

MAN MORE THAN MILLION YEARS OLD, SAYS DR. OSBORN

The human race has existed as a distinct natural division, wholly separate from its nearest relatives, the great apes, for more than a million years, says Dr. Henry Fairfield Osborn, president of the American Museum of Natural History. As far back as the end of the Pliocene period, which preceded the age of ice, there were erect-walking, tool-using, big-brained beings fully entitled to the dignity of human rank.

Dr. Osborn's theory greatly extends the time of man's habitation of the earth beyond the period assigned by most other scientists. He places the relatively large-brained "Dawn Man" of Piltdown, England, as of the Pliocene age, and because of this deduces a long period of development prior to his appearance. He would extend back the time of man, as man, many hundreds of thousands of years beyond that allowed by most other scientists. He also denies man anything like a lineal descent from any of the existing great ape stocks; although he postulates a derivation from a simian ancestry at an earlier date; probably during Miocene time which, some geologists estimate, began 19,000,000 years ago and lasted for about 12,000,000 years.

CHEMISTRY

NEW BLOOD TEST DETERMINES PARENTAGE

Professor Wilhelm Zangemeister of Königsberg University, Germany, has succeeded in determining the parentage of a child by new serum tests of blood samples. The tests depend upon new developments in colloid chemistry, and are indicated by reactions between minute and invisible particles in related and unrelated bloods. Blood samples from the child and the supposed parents are taken and freed from red corpuscles, so that only the clear yellow liquid or serum is left. Samples of serum from the child's blood are then mixed in turn with that from each of the assumed parents. If the mixture shows a certain kind of small, dancing specks when illuminated in a special way under a powerful microscope, this indicates that the real parent has been found. If the reaction is different, the supposed parent is not the real one.

SEX HORMONE ISOLATED BY GERMAN CHEMIST

The important sex hormone has just been obtained in pure form for the first time by a German scientist, Dr. M. Butenandt, working at the laboratory of a recent Nobel Prize winner, Professor Adolf Windaus, at the University of Goettingen. This hormone, which has been known to the medical profession for some years, is thought to be capable of restoring the functioning of the reproductive organs. Heretofore it has been obtained only in combination with other compounds; but Dr. Butenandt has been able to produce the hormone itself in pure form, as a crystalline substance which he has named *progynon.* The sexual hormone is one of a number of curious and as yet little-understood substances which are secreted by the ductless glands of the human body. Each of these special chemicals is responsible for the proper functioning of certain bodily activities; and physiological chemists believe that a systematic study of these secretions will lead not only to an understanding of the physical operations of the body, but even to an explanation of mental characteristics and that elusive property called "character." *Progynon* belongs chemically to the group of stearates, or fats, and it is related to the artificial vitamin, *vigantol*, discovered by Professor Windaus. This also puts it in the same class as the poison of toads and the bile acids.

"Science News of the Month"

portrays in plain yet concise language every important scientific advance during the month. Nowhere can the average reader get such a wealth of accurate and vital information condensed into such a small volume. Some 42 scientific journals as well as a score of other sources are utilized by our editors in the compilation of this department. The publishers welcome short contributions to these pages from the various scientific institutions, laboratories, etc.

HEART BEAT STARTED BY RADIO-ACTIVE POTASSIUM

The potassium in the diet is the radioactive element which normally performs the vital function of starting the heart beat, according to Dr. Charles C. Lieb, professor of pharmacology at the College of Physicians and Surgeons, Columbia University. Experiments seem to have definitely established the fact that potassium is a radioactive element, and now they have indicated that a radioactive element is essential in the initiation of the heart beat. It is, therefore, an indispensable element of diet.

The radioactivity of potassium is one-millionth to one-hundred-millionth that of radium, but even this minute charge is essential to the maintenance of the heart beat.

ROBOT CHEMIST MAKES EXPERIMENTS

A robot chemist with an electric eye, radio brain, and magnet hands, functioned without human supervision in an experiment of the New York Electrical Society, recently. The robot is the joint creation of Dr. H. M. Partridge and Professor Ralph H. Muller of New York University. The ability of the automatic chemist to control chemical operations is owing to its sensitivity to slight variations in color and light intensity. Its working parts are simple. They consist of a standard light source (an electric lamp, usually); a photoelectric cell which detects differences in the amount of light impinging on it; a radio tube which amplifies the signal received from the photoelectric cell, and thus operates the relays controlling the automatic valves. Between the electric light and the photoelectric cell is placed a glass vessel containing an alkali solution which is to be neutralized. Above is a tube through which an acid passes, drop by drop, through an automatic valve into the alkali. A small amount of chemical indicator added to the alkali maintains a red color until it is neutralized. When a sufficient amount of the acid has dropped into the alkali, the red color disappears, indicating complete neutralization.

While the solution is colored red, an insufficient amount of light gets through to the photoelectric cell. As the red color diminishes, the amount of light passing through increases, and when the solution is entirely clear the light reaches a critical value which causes the photoelectric cell to pass a signal to the radio tube. This tube operates the relay which closes a valve and shuts off the supply of acid.

MEDICINE

ARTIFICIAL ATMOSPHERE FOUND BETTER THAN REAL VARIETY

Helium, the gas which makes the American non-inflammable airships possible, may prove of value in helping submarine crews to work more efficiently. Some mixtures of gases, quite different from that which forms the air we breathe, supported life of mice and guinea pigs even better than ordinary air, according to Dr. J. W. Hershey, of McPherson College.

Natural air contains 21 per cent of oxygen, 78 per cent of nitrogen and one per cent of a mixture of gases including carbon dioxide, helium, argon, krypton, neon and xenon. One series of experiments on white mice showed that a mixture of nitrogen and oxygen, in the same proportion as in air, but without the other gases, supported life for only a few days. This demonstrated that the rare gases are necessary for life. In pure oxygen, the animals lived only two to five days; while a similar group of animals, also kept in a large bottle with normal food supply, but supplied with ordinary air, suffered no ill effects whatever. With a mixture of 60 per cent oxygen and 40 per cent nitrogen, however, the animals lived as well as normally, if not better.

ANTI-VITAMIN IN CEREALS MAY CAUSE RICKETS

Oatmeal and other cereals are suspected of harboring an "anti-vitamin" which, when too much cereal is eaten, can counteract the effects of vitamin D and cause rickets even when an otherwise adequate diet is being eaten. Most scientists have concluded that vitamin D, which is found in fats, notably cod-liver oil, can prevent rickets, the disease that causes faulty bone formation, with the familiar bowed legs and bulging foreheads, in infants and children. This disease has been considered due to poor nutrition and principally to a lack of vitamin D in the diet. However, recent experiments with cereals show that rickets is not purely a result of too little vitamin D but due primarily to a lowering of the amount of calcium in the blood, Dr. L. Mirvish of the University of Cape Town Medical School has reported to the scientific magazine *"Nature."*

Dr. Mirvish extracted the "anti-vitamin" substance from oatmeal and injected it into rabbits. He found that the calcium in the blood was lowered as a result of these injections. This bore out and explained the work of other investigators who found that rickets can be induced in young animals by feeding them an excess of cereals, or by adding extracts of cereals to a diet which did not produce rickets.

DISCOVERS SLEEP CONTROL IN THE BRAIN

Dr. Constantin von Economo, Vienna neurologist, and pioneer in the diagnosis of *encephalitis*, has discovered a sleep-control center in the brain. The finding of this center was indicated fifteen years ago by autopsies of the brains of encephalitis victims, which showed extensive inflammation of the brain cells near the junction of the mid-brain and the thalamus. This inflammation was related to the deep stupor brought on by the disease. Dr. von Economo has found that the normal slumber source is a tiny area of the brain cells in the floor of the thalamus (a large ovoid mass of gray matter at the side of the third ventricle at the base of the brain). The activities of the body during waking hours release in the body certain poisons, of a nature still obscure, which, when they are sufficiently concentrated, arouse to action the cells in the sleep-control center.

The sleep-control center is an intricate device of nature to keep the higher forms of life from perishing through repeated complete exhaustions. Sleep itself is innate in all living things, including plants; but in the lower and less active forms of life it does not occur until the poisons are sufficiently strong to affect the entire organism.

ELECTROSURGERY GREAT BOON IN TREATING CANCER

That new and novel adjunct to the surgeon's knife, electrosurgery, finds its greatest usefulness in the treatment of cancer, says Dr. Howard A. Kelly, emeritus professor of gynecology and obstetrics in the Johns Hopkins University. "The most important field for this novel agent lies in the realm of malignant growth and the various tumors." One very important advantage of electrosurgery is that it controls hemorrhage easily without the need of tying off each vein and artery, which must be done at each step of other surgical operations. "In deep operations by older methods the surgeon often loses precious minutes in his efforts to check a severe hemorrhage and feels stopped from going further in that direction," explained Dr. Kelly. With electrosurgery, the lympathics and smaller blood vessels are sealed during the progress of the operation.

MOULD KILLS BACTERIA—MAY BE NEW ANTISEPTIC

One of the moulds (a Penicillium) has been found to kill cultures of some bacteria, notably pus-forming cocci and diphtheria bacilli. This interesting news comes from Dr. Alexander Fleming of the Laboratory of the Inoculation Department, St. Mary's Hospital, in London. The mould is similar to the common fungus which sometimes spoils oranges and other fruits. Even when cultures are filtered, the resultant liquid—*penicillin*—is effective. It can be kept for some time if it is neutralized; but, if not, it loses its power after from 10 to 14 days at room temperature. It does not affect all bacteria; the typhoid group, for instance, are resistant to its action. On the other hand, staphylococci, streptococci and diphtheria bacteria are killed rapidly. *Penicillin* is not toxic to animals, even when given in enormous doses; and it is also non-irritant. It is therefore possible that it may turn out to be a useful antiseptic for combating infections caused by certain pathogenic bacteria.

PHYSICS

ELECTRON "PICTURES" RECORDED ON METAL

Dr. H. P. Carr, working at Cornell University, has discovered a method for taking "pictures" directly on cold, hard, untreated metal without the usual medium of a sensitized plate. According to the announcement, metal, seemingly impervious on its surface, records unseen impressions from streams of electrons. These marks can be made visible by the right kind of "developer"; precisely as photographic images are brought out on sensitized paper.

The discovery opens a new field of scientific development and experiment, especially because metal has been found to be sensitive to electronic impressions. Some metals are almost as sensitive to electron rays as photographic film; and some are much more sensitive than film for very low-velocity electrons. Gold plates are developed with mercury vapor; silver plates with iodine; zinc plates with hydrochloric acid; and copper plates with iodine.

DIVIDES SECONDS INTO BILLIONTHS

A new camera has been devised—a spectroscopic camera with a shutter which operates in about one-billionth of a second. By means of it physicists at the University of California have been able to take pictures of the action of light at various stages of the course of an electrical spark which lasts only one-hundred thousandth of a second.

The camera was invented by Dr. J. W. Beams, of Yale University, and developed by Professor E. O. Lawrence of the University of California. The shutter itself, which operates in an infinitesimal amount of time, is not mechanical, but works automatically through the application of a physical law of light. It may be said that the photographed spark takes its own picture. The spectroscopic camera is set up at the end of a long corridor. When the electrical current jumps across the spark gap, it sets up a momentary current in a set of wires running the length of the corridor and connected with the camera. This current travels at about 186,000 miles a second, the speed of light. At the same instant, the light of the resulting spark starts toward the camera at 186,000 miles a second. It is a race between the spark current and the spark light. Inasmuch as the current flows just before the spark appears, it is possible for the current to reach the camera and close the shutter even before the light which is to be photographed has arrived.

SUGGESTS EXISTENCE OF FIFTH DIMENSION

Professor O. W. Richardson, director of research in physics at Kings College, London, and winner of the 1929 Nobel Prize, has suggested that there may be a fifth dimension, which is a missing link in the more intricate and baffling problems of physics. The scientist, however, cannot describe this dimension. According to him, his field of activity has become more and more incomprehensible. The quantum theory does not lead to a domain where the law of cause the effect vanishes; we may be overlooking the existence of some other yet unknown law, entirely unpredictable. A fifth dimension could explain many phenomena. Some facts already known could be coordinated with such a hypothesis. For example, we can interpret along those lines the fact that the number of elements is limited to ninety-four, and also the extraction of electrons from cold conductors by strong electric fields. The fifth dimensional hypothesis may prove a bridge over the inconsistencies presented by the quantum and relativity theories.

MERCURY TO REPLACE WATER AS POWER GENERATOR SAYS ENGINEER

That mercury will replace water in the future as a generator of power is the belief of Alfred D. Flinn, director of the Engineering Foundation, New York City. Based upon mercury-vapor boilers installed at Hartford, Conn., and in service for six years. Mr. Flinn sees that, due to its thermodynamic properties, mercury is superior to water. Mercury boils at 675 degrees and has a temperature of 884 degrees at a moderate pressure of 70 pounds per square inch and a temperature of 1,000 at a pressure of 180 pounds. Because of the higher temperature at which it can be worked and the correspondingly greater heat fall, mercury promises well as a source of power.

EINSTEIN SEES KEY TO MATTER IN SPACE

Professor Albert Einstein, the great German physicist, has pointed out the development of the relation between space and matter in a lecture entitled "Physical Space and the Ether Problem." The problem was first recognized by the Greeks, and it has had contributions from men in all ages until the present time.

"The special relativity theory," said the scientist, "combines space and time; but the universal relativity theory puts space, ether, and field into a unified form. Space has swallowed time and ether, and is now attempting to swallow field and correlative. When we have advanced so far, this conception of space will provide us with a key for the theory of the atomic components of matter." This is one explanation of the methods of arriving at four-dimensional space.

INVENTS COLOR WAVE PIANO

According to John MacCormac, writing in the *New York Times*, a "light piano" has been constructed in support of an alleged discovery that there exists in nature an absolute relation between sound and color, so that one can be made to evoke the other. Baron Anatol Vietinghof-Scheel, inventor of the color-wave piano, contends that his instrument will evoke colors which actually correspond in nature to the musical tones represented by its keyboard. Since sound is produced by air waves, and color by "ether waves," both are differentiated by the length of their waves; and the inventor believes one stimulus will produce the other. He found that, when he directed the light of a certain color on the strings drawn to a certain tension he could make them vibrate, producing sound. Reversing the operation, he discovered that vibrating the strings, after prolonged exposure in a pitch-dark room, affected a photographic plate, and that by varying the tension he could produce different colors. Finally, it became possible to correlate with certainty some specific tones and specific colors. The tone of C, for example, evokes a deep red. In a rendition of Chopin's "Minute Waltz," the colors danced rapidly, doubling the effect of the music.

RADIO-TELEVISION

SHORTEST RADIO WAVE SUCCESSFUL

Scientists in Berlin have tested successfully ultra-short radio waves that vibrate almost as rapidly as infra-red rays. The experimenters, headed by Dr. Schroeter, of the Telefunken-Gesellschaft, have tested wave lengths varying from several decimeters down to less than one one-thousandth of a millimeter which is in the spectrum of invisible light.

A selenium cell to which thallium sulphide had been added was found to be a detector sufficiently sensitive to respond to the short wave. Even in dense fog, the scientists succeeded in telegraphing and telephoning 2½ miles with a 100-watt transmitting tube.

PLANE TALKS TO LINER FAR AT SEA

The *Leviathan*, world's largest ocean liner, which recently established telephone communication with the Bell Telephone Laboratories in New York, has been able to maintain a telephone connection with an airplane in flight more than 700 miles away. This latest development in wireless telephony is the culmination of a long period of research.

To establish the connection, the plane, 1500 feet in the air, lowered a trailing antenna, through which radio communication with the Bell Laboratories at Whippany, New Jersey, was maintained. The contact with the liner was then made. The voices were relayed through New York by wire to the broadcasting station at Deal Beach, N. J., and then carried by radio to the ship. The voices were heard as clearly as on an ordinary inland telephone. On the plane the equipment included a generator driven by the engines, earphones, and hand microphones fitted with a large rubber mouthpiece to shut out the roar of the motors. Beside each seat was a contact box with two plugs, one for the microphone and one for the earphones. The connection was made by pressing the button on the hand microphone to open the circuit.

IMPROVES "SHADOW MUSIC"

Professor Leo Theremin, inventor of the musical instrument which operates on a radio principle and produces the tones of a stringed instrument when the hands are waved before it, has found a way to make his device sound like an organ, a violin, a saxophone, an English horn, or the human voice. By combining his radio-electric oscillators, Professor Theremin is able to produce remarkable effects in weird sounds, as well as in tones resembling musical instruments.

RADIO FOGHORN COUNTS MILES

A new radio and sound-wave device by which a voice counts in the ear of a ship captain to tell him just how far he is from shore has been perfected in Scotland. The device is to be used to aid fog-bound ships.

At the instant of each blast of the foghorn, an automatic apparatus at the same station begins to count over the radio waves "one," "two," "three," and so forth; as though a person were counting into the microphone of a broadcasting station. The intervals between these counts are approximately five seconds each, which is the time sound waves take to travel a mile. A ship in the fog off this speaking lighthouse listens both for the radio signals, by means of a simple radio receiver, and for the audible blasts of the foghorn. A convenient arrangement for the listening officer allows him to put the radio telephonic receiver against one ear and listen with the other to the blasts of the foghorn. The speed of the radio waves is so great that they are received the instant they are broadcast. The sound waves are much slower; and accordingly the listening ship hears the radio count begin when the blast of the foghorn leaves the lighthouse. If the sound arrives just as "one" is being counted it means the ship is one mile distant, and so on.

WINDS MEASURED BY RADIO

The U. S. Army Signal Corps meteorological stations of the government have devised a means to make radio track the path of the winds. Lieutenant Carter W. Clarke, writing in the *New York Times*, describes the instrument used, as consisting of a cluster of three hydrogen-filled balloons, each 36 inches in diameter, to which is attached a miniature radio transmitter.

The "loop" consists of a radio receiving set with a loop antenna. To the shaft supporting the loop is attached a calibrated dial graduated in degrees and fractions of degrees, which is used for measuring the angles through which the loop may turn. The purpose of the loop is to determine, by means of radio, the velocities and directions of the winds at successive elevations above the surface of the earth. The transmitter attached to the balloons sends out continuous waves and, when these are caught by the "loop," mathematical calculations and visual observations assist in determining the direction and velocity of the wind.

GENERAL

VAST SALT LAKE FOUND IN AUSTRALIA

What may be described as another wonder of the world has been discovered in Australia by Cecil Madigan, an explorer. It is a vast salt lake with a type of surface never before encountered. The surface of Lake Eyre is covered with encrusted patches of crystal salt, like ice floes on the Arctic seas. The place has every characteristic of a lake—except water—and even has steep shores thirty feet high. According to the explorer, the lake contains a limitless supply of salt, with at least 3,000,000,000 tons in the northern part alone. If potash is found in the salt deposits, the lake will possess an enormous commercial value.

The lake is apparently solid in most places, in spite of the tales that thousands of head of cattle have been swallowed up in it. In all probability the lake contained genuine fresh water more than 50,000 years ago; and the five great waterways which fed it dwindled to small salty streams.

HUGE SUN SPOTS PRESAGE GOOD RADIO CONDITIONS

Great activity on the sun, visible from the earth as a 700,000-mile row of sunspots, has brought poor radio reception in recent weeks; but it will probably be followed by a gradual return to the good conditions of 1923, declared Dr. Harlan T. Stetson, director of the Perkins Observatory at Ohio Wesleyan University. He believes the recent solar disturbance probably represents the peak of the present eleven-year sunspot cycle. In collaboration with Dr. Greenleaf W. Pickard, radio engineer of Newton Center, Mass., Dr. Stetson has been studying the relation between sunspots and radio. According to the theory, the sun constantly bombards the earth's atmosphere with electrons or bundles of energy of high frequency which, in turn, tear apart the positive and negative charges of the atmospheric molecules. In other words, they ionize the atmosphere to a very considerable extent, thus producing the Kennelly-Heaviside layer. If the sun is more active on occasions, as when large spots appear on its surface, the degree of ionization increases, producing substantially the effects of lowering the Kennelly-Heaviside layer and upsetting the radio reception. When the sun is again less active, the atmosphere tends to return to its normal state of ionization and radio broadcast reception tends to improve as the ionized layer lifts.

LIQUID FUEL SUCCEEDS IN RECOIL AUTOMOBILE

Max Valier, rocket car experimenter, and proponent of a rocket flight across the ocean, has tested his recoil automobile with liquid fuel instead of with rockets, and succeeded in attaining a speed of over 60 miles an hour. The new fuel, unlike the rocket, insures the driver's absolute control of the car, and gives smoother operation. The Valier car is without springs; the driver's seat is in the center, with four fuel containers in front of it and two behind it.

The new fuel tested was benzine combined with liquid carbonic acid. While the liquid fuel did not give the 225 miles an hour attained by the rocket propulsion system, it is expected that further experiments will reveal a method whereby that speed may be attained.

TO MAKE STORMS TO ORDER

The Westinghouse Electric and Manufacturing Company will build a central engineering laboratory where artificial storms, lightning, and other phenomena, will be produced at will. Generators big enough to supply electricity to a town of 10,000 will be used merely for experiments. By means of the equipment, artificial lighting for testing insulating materials will be produced. Artificial weather, too, will be made every day—sunshine and rain, cold and heat. Atmospheric conditions of any kind, temperature, pressure, or humidity, will be easily brought about.

PHYSICIST'S MOTTO AIDS IN REMEMBERING CIRCLE RATIO

"How I want a drink, alcoholic of course, after the heavy chapters involving quantum mechanics." This hypothetical appeal of the American scientist who had just finished reading a book on modern physics is the latest method of remembering the value of "pi," the famous number by which the diameter of a circle must be multiplied in order to find its circumference. Write under each word the number of letters that it contains, and you have 3.14159265358979, which is the value of this number, expressed with far greater accuracy than the ordinary 3.1416. *"The Observatory,"* English astronomical journal, gives this sentence, along with several others of a similar nature, in its November issue, with the remark that it is adapted to the United States. J. H. J. is given as the author; and the initials happen to be the same as those of Sir James H. Jeans, leading British astronomer.

GULF STREAM TEMPERATURES MAY REVEAL WEATHER

Measurements of the exact degree to which the temperature of the Gulf Stream varies from one side to the other may aid in forecasting weather in the eastern United States, says Professor Charles F. Brooks, of Clark University. Recording thermometers have been placed on ships crossing the Gulf Stream at five different places in the Straits of Florida.

"High temperature, speed, magnitude, and location make the Gulf Stream the best known of ocean currents," said Dr. Brooks: "The habitability of northwestern Europe is commonly ascribed to the high temperatures of the Gulf Stream, though this current is only part of the warm flow that ameliorates European climate. The importance of the Gulf Stream and the other warm waters of the western Atlantic has still to be fully appreciated. These warm seas are the progenitors of storms and the sources of rainfall."

SYMPATHETIC MAGIC IN MODERN SCIENCE DEPLORED

Use of sympathetic magic in modern disguises in the dignified laboratories of science is deplored by Prof. Knight Dunlap, of Johns Hopkins University, in a communication to *Science*. The idea that like produces like was one of the earliest primitive ideas, judging by pictures of wild animals pierced with spears or arrows which cave men of Europe painted in the expectation of bringing luck to their hunters. Early doctors, convinced that like cures like, sought plants that resembled human organs and used these plants as specific remedies. "This old assumption that a cause in some simple way resembles its effect has been a great obstacle to progress," says Prof. Dunlap. The psychoanalytic theories of Freud literally prescribe operations in sympathetic magic to remove "repressed desires."

The most pernicious form of sympathetic magic which afflicts modern science is found in the efforts of scientists to demonstrate certain principles of inheritance, such as the "transmission of acquired characteristics." It has been believed, for example, that if parents engage in some intellectual pursuit, such as the study of higher mathematics, their activities may affect their progeny. This, in Dr. Dunlap's opinion, is worthy of investigation; but he considers it extremely unlikely that the acquired facility of parents in dealing with figures would be specifically transmitted to their children—that is, that the effect would resemble the cause.

Science Questions and Answers

THIS department is conducted for the benefit of readers who have pertinent queries on modern scientific discoveries and on established scientific facts. As space is limited we cannot undertake to answer more than three questions for each letter. The flood of correspondence received makes it impractical also to print answers as soon as we receive questions. However, questions of general interest will receive careful attention. If you desire individual answers to your queries, enclose 25c in postage to cover time and mailing.

The Energy of Light

In the November issue of SCIENCE WONDER STORIES in an article under "Science News," you mentioned an article that stated that light loses no energy in its passage through empty space.

Hasn't this fact been known for years? Isn't it taken for granted in applying the inverse-square law to light, gravitation, and other forces?

Otherwise, so applied, this law would be an absurdity.

J. B. Thompson,
St. Louis, Mo.

Illustrating the application of the inverse-square law to the distribution of the energy of light.

(Theoretically Mr. Thompson is quite right. The inverse-square law applied to the dispersion of light assumes that there is no energy loss. In the accompanying diagram, S represents source of light. The light is strongest in the space between S and the cone of A. Between A and B it is weaker, as indicated by the shaded volume. Between B and C cones the light is weaker still, and so on indefinitely. The light spreads, and becomes diffuse.

Now, if the plane to the right of B is twice as far from the source S as the plane to the right of A, and the inverse-square law applies, the intensity of light at B will be one-fourth that at A. This is experimentally a fact. But inasmuch as the area at B is four times that at A the total amount of light received is the same, thus indicating no loss between.—Editor.)

The Origin of the Moon

Editor, Science Questions and Answers:

1. There is a theory which states that the moon was once part of the earth. If it is, why could there not be life on the moon resembling the life on the earth?

2. I understand that the moon is receding from the earth, even now? If this is so, will it ever return? And if it does, will it return slowly or will it be shooting through space like a comet?

Earl Baird,
La Follette, Tennessee.

(1. Mr. Baird refers to the "Tidal Theory" upheld by Sir James Jeans and other eminent astronomers: the theory that, when two heavenly bodies come close to each other, each tends to raise a tide in the other. If the bodies are gaseous and approach close enough, the tides take the form of great masses of gas flung from, usually, the smaller body. In the case of the earth and the moon, it is supposed by some that the earth was one of the first planets to cool, after having been flung off by the sun. At that time it pursued an erratic orbit, and it may have passed so close to the sun that a great mass of gas was pulled away. The moon is supposed to be the result of this disruption.

The possibility that the moon was once part of the earth has nothing to do with the kind of life possible on the satellite. If we accept the "Tidal Theory," then, at the time the moon was flung off the earth, it is of course obvious that no life existed at all on either moon or earth. However, life depends upon the peculiar conditions of the planet on which it exists—atmosphere, temperature, air pressure, the size of the planet, its internal conditions, and so forth. We human beings are only one of myriad forms of life on this planet. An accident, it is assumed, made us supreme over other types of living creatures. Circumstances, or some other accident, might make any one of a thousand forms of life supreme on the moon—if the moon could sustain life.

2. At the present time the moon is revolving around the earth in its regular orbit. However, it is receding—very, very, gradually, but still receding. In several million years, according to Dr. Shapley, of Harvard, it will have receded to its maximum distance from the earth; and from then on it will begin to approach the earth. When it comes within a distance of two radii of our planet (8000 miles), it will be acted upon by both the gravity of the earth and the gravity of the sun, with the result that the tremendous pull will burst it asunder. Then it will take the form of thousands of tiny bodies encircling the earth, and this planet will have a ring like Saturn. —Editor.)

How Selenium Is Used

Editor, Science Questions and Answers:

I am an ardent reader of SCIENCE WONDER STORIES. I wish that you would publish stories concerning chemistry. I would also appreciate it if you would explain the action of light on selenium, mentioned in "The Phantom Televiewer" in the November issue.

I would also like to correspond with other readers who are interested in chemistry.

John Dietrich,
Altoona, Pa.

(Selenium is an element which has peculiar properties. When rays of light are focused upon it, it becomes a conductor of electricity; in the dark, it is a non-conductor. Just why selenium acts in this manner has not been determined as yet, but we have proof that it does act that way. For this reason selenium is of especial use in a great variety of electrical devices, operated automatically by the light which shines on them, in proportion to its intensity.—Editor.)

The Hydraulic Press

Editor, Science Questions and Answers:

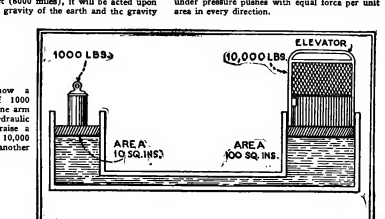
1. If one has an original theory, a good one, as to the cause of any specified astronomical or meteorological phenomena, with whom should he get in touch in order to have some consideration taken of it?

2. Please explain briefly the principle of the hydraulic press.

E. W. Smith,
541½ Church Street,
Ottumwa, Iowa.

(1. The person who thinks he has a good theory on astronomical events should consult first with local scientific authorities—such as professors, or teachers of science. After that, it may be expedient to write to one of the larger observatories—such as the observatory at Harvard University, Cambridge, Mass., or the Naval Observatory at Washington, D. C.

2. The hydraulic press operates by the application of a law of physics known as "Pascal's Law." This law states that "Liquids transmit pressure equally in all directions, and the forces transmitted are normal to the surfaces and proportional to their area." In other words, water under pressure pushes with equal force per unit area in every direction.



Showing how a pressure of 1000 pounds in one arm of a hydraulic press will raise a weight of 10,000 pounds in another arm.

Thus a weight of 100 pounds pressing on a surface of 10 square inches exerts a force of 10 pounds per square inch in one arm of an apparatus. This will counterbalance a weight of 100 pounds pressing on an area of 100 square inches (10 pounds per square inch) in another arm of the apparatus. The operation of the hydraulic press is shown in the accompanying drawing.

In the diagram a weight of 1000 pounds presses upon an area of 10 square inches. This power is transmitted to the other arm of the apparatus, which has an area of 100 square inches; the pressure on this raises a weight of 10,000 pounds, and forces it upward. Thus we have illustrated the principle of the hydraulic elevator, showing how the pressure of 1000 pounds in one arm of an apparatus causes a pressure of 10,000 pounds in another arm.—Editor).

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The Reader Speaks

IN this department we shall publish every month your opinions. After all, this is your magazine and it is edited for you. If we fall down on the choice of our stories, or if the editorial board slips up occasionally, it is up to you to voice your opinion. It makes no difference whether your letter is complimentary, critical, or whether it contains a good old-fashioned brickbat. All are equally welcome. All of your letters, as much as space will allow, will be published here for the benefit of all. Due to the large influx of mail, no communications to this department are answered individually unless 25c in stamps to cover time and postage is remitted.

Time Travel and Evolution

Editor, Science Wonder Stories:

In reference to the discussion of the question of time traveling, and in answer to the question "Can a time-traveler go back and take part in the life of the past?"—my answer is NO. In the first place, the person making the trip would be going back as a "modern" and would not belong to the age to which he traveled. I do not think the machine which takes him back will implant in him the thoughts and manners of time past. As illustrated in "The Time Oscillator," the time-traveler was an onlooker. I believe, were such an invention to come forth, that those who use it to travel back would he merely onlookers. According to the theory of evolution, which claims that man and ape had a common ancestry, a man who traveled hack a hundred thousand years might find himself an ape, or, if he traveled back a million years, he might be a lizard. That is as clear as I can explain it, as I am not a scientist.

M. G. Benjamin,
Musical Director "Step Lively" Company,
En route.

(Mr. Benjamin's letter is interesting hecause it hrings up the question of time-traveling in its relation to evolution. It is our opinion that a man can travel forward into the future, as shown hy Wells in "The Time Machine" and by Ray Cummings in "The Man Who Mastered Time." We do not believe, however, that a man can take part in the actions of the past, even though he may travel back in time to watch them. If a man could go back to prehistoric days, he would not assume the shape he wore at that time; but he would see what people really looked like before they assumed their present form. If a man could go back in time and kill his own ancestors, he would prevent his own birtb, which is a logical impossibility.—*Editor*).

The Fallacy of It

Editor, Science Wonder Stories:

I have just finished the December issue of SCIENCE WONDER STORIES and I want to discuss some of the points on time traveling brought out by "The Time Oscillator."

First of all, I would like to state that all time traveling is based on a fallacy. How is it possible, by any method, to *travel* ahead? The one thing that I will admit before I go on is tbis: that I helieve that some day, in some way, it will be possible to look *back.*

The fallacy in the idea of *travelling* hack into time is this: that in travelling backward we are still going into the future, because time stops for no man. That is to say, a man goes (theoretically) back into time for one day. Still, while he is back in time, he is still advancing into time. Also, how is it possible for a man to go the opposite way that time is going? The only way that that could be done is to go so much more slowly than time that you are going slower than time at a given moment.

This is to say that you are going faster against time than with time. If hy that means, known or unknown, one could go back into time, he could only go back to some time within his own life span; and then the actions that he did would he the same ones that he had done at that time; and his tboughts would be the same as they had been at that time. Similarly with going into the future; tbe person who did the "time-traveling" would do the same thing and think the same thoughts that he would have done if he reached that future date by natural means. When he returned to the time from which he started, he would not he able to remember anything, that occurred in the "future." In other words, while going into the past, the person also goes into the future. The whole problem forms a paradox. It is like trying to answer—What would happen if an irresistible force came into contact with an immovable object? The question contradicts itself by the provisions in it.

Let me enumerate some of the improhahilities of the problem:

Suppose that it is possible for me to go into the future, a few days. I can do as I desire in that space of time. Let us suppose that in that space of time I commit suicide, and that someone else is controlling the time machine. When he brings me back to the present time I will have "risen from the dead."

Another thing; if I could murder my own forefather the paradox pops up again. It stands to reason that if time-travel were a real thing, that one could only go to some time within his life span.

Supposing that there were such a machine; then by attaching it to a radio one could hear things before they have been broadcast. It is the same principle.

The only time traveling that may ever he done is that which brings up scenes from the past.

Michael Levy,
B. M. I., Bordentown, N. J.

(Mr. Levy mentions some fallacies in time-traveling which are fallacies only so long as a certain conception of the phenomenon is maintained. It is our opinion that a man can go back in time; but that he can take no part in the actions of the past. In other words, he can view the actions of his ancestors for as many generations back as he pleases, but he cannot kill any of them. This does away with the question of preventing one's own hirth. In a similar manner, one may travel into the future, and observe what is to take place; but he will not be able to direct actions in any way whatsoever, eliminating the future "suicide" premise.

As to time stopping for no man, the time-traveler does not expect time to stop for him. Time goes on as always; but the person in question is able to travel back into time even while he is traveling forward into time. He simply makes use of the newer conceptions about the various planes of existence on which one can live. It is always necessary in meditating over this problem, to free ourselves from our usual conception of the meaning of time and to try to accustom our mental perspective to the possibility that time has no real existence in itself—that it is only an attribute of space.—*Editor*).

ON LETTERS

BECAUSE of the large number of letters we receive, we find it physically impossible to print them all in full. May we request our correspondents, therefore, to make their letters as hrief and to the point as they can; as this will aid in their selection for publication? Whenever possible, we will print the letter in full; but in some cases, when lack of space prohibits publishing the complete letter, we will give a resumé of it in a single paragraph.

Death to Harold Dare!

From far Honolulu comes the plea of William J. Boone for the death of Harold Dare! Mr. Boone is satiated with stories which "are far past rotten—they are putrid." The "Radiation of the Chinese Vegetable" hrought about this unholy prayer, and at the same time it gave him an opportunity to ask for more great stories like "The Shot Into Infinity" and for tales of lost Atlantis.

Another Contest Idea

Editor, Science Wonder Stories:

Thank you for giving me the second prize in the Fundamental Error Contest. I was somewhat amused at reading your comment. "Of course, the correct answer was not immediately apparent." I imagine that the great majority of your usually unheard-from readers immediately "spot" errors in reasoning and logic as they read. However, as the best of authors make mistakes, the intelligent reader does not let them detract from his interest in the stories. Of course, technical errors are something else, again. Very few have the necessary knowledge in all the sciences to detect them all.

It might be an interesting experiment to publish another story containing a fundamental error without indicating what the particular story is. Merely announce that one story in that issue contains an error and see how many of the readers name the right story. To save wear and tear on the judges, you might caution contestants with the City Editor's favorite commandment—"Tell it ALL in the first sentence!"

J. W. Lodge,
1424 West Congress Street,
Chicago, Ill.

(The Fundamental Error Contest, which was a great success, may he repeated soon. However, it would not he advisable to have a contest without naming the story. Readers would get confused and look for errors where they do not exist, and some of them would prohahly find "errors" in perfectly sound stories.—*Editor*).

Einstein and Breuer

Editor, Science Wonder Stories:

I was much pleased with "The Fitzgerald Contraction" by Dr. Miles J. Breuer, although I believe its mathematical field could have been more thoroughly exploited. This story, however, hrings up the old dispute of the straight line being a curve. A straight line may exist in theory, but could a projectile follow such a course, it could never return to its starting place. Einstein has not yet found an acceptable proof that the universe is finite, and until this is done, the postulate that two points determine a straight line must he taken as the truth.

I see that Dr. Keller is again hitting the height of imagination. It is a known fact that there is no reason to believe that the human skull has increased in size for the past fifty thousand years. Furthermore, the intelligence of a person depends upon the number of convolutions in the hrain, not its size.

James E. Suiler,
751 Bergen Avenue,
Jersey City, N. J.

(Dr. Breuer's hypothesis is mathematically and theoretically sound. Einstein believes, and he has shown hy mathematical demonstration, that the universe is finite, although it is infinite as far as we are concerned; for a man might go on and on, and for practical purposes never come to its end. Of course, one cannot expect Einstein to bring forward a physical proof of his theory; but the fact that most of the world's leading scientists have accepted it—and scientists are the most critical and uncompromising people in the world—is indicative of its value.

The size of the brain has a great deal to do with the intelligence. Dr. Henry Fairfield Oshorn classifies intelligence by the ratio of the hrain weight to the rest of the body. The greater the ratio, the greater the intelligence. And it has heen found that we can, to a certain extent, control evolution. Racial characteristics have heen changed, and new developments in this field are being announced constantly—*Editor*).

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Maintaining Air Pressure

Editor, Science Questions and Answers:

I have been reading your magazines for over a year. I enjoy every story, and my favorites are the interplanetary stories. However, I think I have found fault with every one I have read. The authors explain very clearly how they think a machine could be taken to another world. Some even think if an accident happened, the men could go out of the machine in suits, provided with air packs, and repair the broken part. But wouldn't the same thing happen to the men that has happened to deep-sea creatures that have been brought to the surface of the water? They would burst open because of the lack of pressure.

The air has a pressure of 14.7 pounds per square inch at sea level in the latitude of Washington. Man has been built to withstand this pressure of the air. Take away this air and there is no pressure. It seems to me that the interplanetary machine would have to hold the pressure in such manner as a submarine is built to keep the pressure out. I do not remember any author using this fact in the building of his machine. If a man went out into the void, he would have to have a steel suit strong enough to withstand a pressure of almost 15 pounds from the inside. Without this suit, the man would burst open the same as a deep-sea fish.

Theodore Boggus,
1819 Jefferson Ave.,
Houston, Texas.

(The statement concerning the lack of air pressure in interplanetary space is quite correct. However, the writer should remember that steel can withstand a pressure of more than fifty thousand pounds per square inch; so the possibility of maintaining an air pressure of fifteen pounds per square inch within the suit is quite understandable. Such suits can readily be made of various substances, such as for instance bronze wire screening covered with flexible rubber on both sides.—Editor).

Does the Solar System Revolve?

Editor, Science Questions and Answers:

1. As I understand it, our solar system is traveling somewhere at the rate of eight miles per second. Is it possible that this system is traveling around a huge gun, just as our earth is traveling around our sun?

2. How can paleontologists tell the age of fossils?

Fred G. Michel,
887 Milton Street,
Oakland, Cal.

1. The solar system as a whole is moving in the general direction of the star Vega at a speed of 12 miles per second. So far as we know, it is moving in a straight line, not in an ellipse, as it would if it revolved. However, between a straight line and a curve of thousands of light-years radius, the difference is not readily apparent. The argument against the existence of so huge a sun, however, is obvious; if there were such a sun, we should be able to see it.

The phenomenon of the sun revolving about another body may be explained in terms of galaxies. The sun is part of a galaxy called the "Milky Way." This galaxy, in turn, is part of still another galaxy, called the "greater Galactic system," which is about 300,000 light-years in diameter, or approximately 1,800,000,000,000,000,000 miles across. This terrifically large galaxy is believed to rotate upon its own center of gravity, represented by the great star clouds in Sagittarius. It is not necessary for our sun to revolve around another sun; it may revolve around a group of bodies, like a star cluster. Our own sun revolves around the center of gravity of its cluster; and its cluster revolves around the cluster in Sagittarius. The great mass concentrated in the latter cluster exerts a tremendous gravitational pull, and forces our whole starting galaxy to revolve around it. While the stars of the greater galaxy revolve around the center at about 180 miles per second, our own sun moves at 12 miles a second, with relation to the stars of its own galaxy.

2. The age of fossils is determined with relative accuracy by the strata of earth in which they are found. Geologists have calculated the various glacial periods and the various historical periods which have left permanent records in the

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earth down to a depth of over a mile. If a fossilized skeleton is found, let us say, in a bed of coal, we know that the creature died in the age when the great prehistoric trees were being pressed into the earth, to be found millions of years later as coal. The dates which represent each stratum have been determined, rather accurately. The fact that fossil remains are found in various geological strata is incontestable proof of the age and the period from which the remains date.—Editor.)

How Long To Go 1,000,000 Light Years

Editor, Science Questions and Answers:

I have read both SCIENCE and AIR WONDER STORIES and wish to say that every story is good. I think it is a fine idea to have the "Science Questions and Answers Department." I have a question I should like to have you answer.

How long would it take a space flyer to go 1,000,000 light years if the flyer can go 250,000 light speeds?

F. Woyenda,
Baltimore, Md.

(We assume that what is meant by 250,000 "light speeds" is that the flyer can go 250,000 times as fast as light. This is a sheer impossibility. However, if we assume that is what is meant, then the time taken to travel 1,000,000 light years would be 1,000,000/250,000 or four years.—Editor.)

MOLECULES AND ATOMS

Editor, Science Questions and Answers:

What is a molecule? What is an atom? What is an electron?

Richard Parkinson,
1104-79th Street,
Brooklyn, New York

(A molecule is the smallest particle into which matter can be divided without effecting a chemical change in its nature. For instance, the molecule of water is the same whether it is in the state of a gas (steam), a liquid or a solid (ice). If the molecule is split, it exists no longer as water, but as two different substances, oxygen and hydrogen. The atoms are the units of hydrogen and oxygen, which combine to form the molecule. The atoms were, until a few years ago, regarded as indivisible units, but it has been discovered that the composition of the atom is a complex one, and that it is possible for one to be split, thus transmuting one element into another.

A molecule may contain only one atom (as in the case of helium) or two similar atoms (as in the case of the oxygen molecule); but in most cases it is a combination of atoms of different elements. No molecule is large enough to be visible, even under a microscope; but a great deal of information as to their structure has been obtained by X-ray photographs and other experiments.

The heat of a body is the motion of its molecules; and, especially in the case of a gas, the molecules are very active, always colliding with each other and rebounding. It is this motion which causes the unlimited expansion of a gas, whenever pressure on it is relieved. In a gas, a single molecule may collide five million times a second with other molecules. To give an idea of the smallness of a molecule, it has been said that a drop of water has more molecules than the Atlantic Ocean has drops of water.

There are more than less than a hundred different known kinds of atoms, each forming a different chemical element. The difference between them is the number of unit electric charges on them, and consequently their apparent mass. Every atom contains a certain number of unit positive charges and the same number of negative charges; the number is the same in each atom of one element.

The electron is the unit of negative electric charge; every atom must contain at least one (as in hydrogen). The electrons are always revolving with great rapidity around the positively-charged nucleus or "proton" of the atom. An atom may be separated temporarily from one or more of its electrons, and thereby apparently acquires a very strong positive charge of elec-

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tricity; in this state, it will pick up any loose or "free" electron which comes its way, and restore the balance.

The theory of the internal composition of the atom is still subject to modification. Scientists are puzzled as yet whether to say that the electron is truly matter, as we ordinarily understand it, or whether it is simply a concentrated electrical field. According to Dr. Irving Langmuir, a leader in atomic research, the electron is simply a mathematical quantity. Some theorists say even that the proton, or positive particle, is also merely an electrical charge without a material substance.—Editor.)

Direction of Electric Currents

Editor, Science Questions and Answers:

I got into an argument with my instructor in electricity as to whether electric current flows from positive to negative, or from negative to positive. I say it has been definitely proved to be from negative to positive; while he says it is not definitely known. Will you please enlighten me on this point?

R. C. Jones,
Toledo, Ohio.

(In the early days, when the nature of electricity was not well known, scientists agreed, for the sake of convenience, to assume that the flow of electricity is from the "higher" to the "lower" potential, or from positive terminal to negative. If we take away electrons from the surface of any object, we make an electrical hole, so to speak, into which electrons will flow at the first opportunity. This is what we mean by a flow of current.

So what we call a flow of electricity in a wire is a movement of electrons only; and they move from "negative" or point of "low" potential (that is, where they are most crowded) to "positive," a point of highest potential, where they are fewest. So the argument turns on what is really meant by a flow of electric current. What is understood, scientifically, by that is a flow of electrons from negative to positive—opposite to the conventional symbols of direction of current flow.—Editor.)

The Gas Refrigerator

Editor, Science Questions and Answers:

1. How do the new red daylight signs work?
2. How does the gas refrigerator work?

Joseph Hewes,
51 Stearns Road,
Brookline, Mass.

(1. The red daylight sign works by collecting and reflecting the light that strikes its upper surface; so even when there is relatively little light in the street it will operate from the much brighter sky. The light is passed through an upper frame of very clear glass, which covers a black box, in which is a reflecting mirror. The mirror is at an angle of forty-five degrees to the sky and to the translucent sign through which it reflects the light. The black box allows light to enter only at the top.

2. The gas refrigerator operates on a simple principle. The power is supplied by a small gas flame, which changes the water and ammonia in the refrigerating liquid to vapor. This vapor does not collect in one place, but moves away from the source of heat through several coils. Then it is condensed to liquid form again by a trickle of water. As a liquid, it is again acted upon by the gas flame, and the process is repeated again and again. It can continue indefinitely, so long as heat and cooling are alternately applied.

The refrigeration is produced by the expansion of the ammonia vapor through the coils. In expanding, a gas cools, and, by absorbing the heat from the coils, it cools the coils themselves. The condensation of the ammonia takes place at the maximum temperature of the cooling water; its condensing temperature is determined by the introduction under pressure of hydrogen or some other inert gas.—Editor.)

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Light Years and the Universe

Editor, Science Questions and Answers:

1—What is a light year and how many miles are there in one?

2—Where is the center of the universe?

Norman Baumgarten,
Bronx, New York City

(1—A light year is a measure of distance used in astronomy. Light travels at a speed of 186,000 miles a second. The distance in a light year is found by multipying the number of seconds in a year by 186,000. The number is approximately six million times one million miles—6,000,000,000,000.

2—The center of the universe, in the unscientific estimation of ancient and medieval sages, was the earth. In the astronomical sense, there are a great number of "universes," of which our own is only one. These others are known as "island" universes because they are off in space by themselves. The sum of all the universes taken together makes up the "cosmos." The cosmos is so immense that we have not been able to calculate its extent, let alone find its center. It is estimated, however, that our own universe is not far from the center of the cosmos.—Editor.)

About Lunacy

Editor, Science Questions and Answers:

Is lunacy caused by a person's actions being controlled by the subconscious instead of the conscious mind?

Going on the theory that a person cannot live without some sort of a mind, is it not possible that when a man has studied or worried too much about some subject, and his conscious mind confines itself to one subject, his unconscious steps in and controls the rest of his actions? Is this not, instead of insanity, an extreme form of absent-mindedness?

Or when his intellect has been paralyzed by a great emotional shock, as in the case of a bad wreck, a killing, etc?

These questions have been brought up before: what I would like to know is, is it possible to appeal to him with the simple things which interest him, awakening his interest in things and finally getting his mind to working at normal? (This, of course, means that only one mind can have complete control at a time, that the unconscious mind, incapsble of reasoning, has control of the body; and that as interest gradually returns the conscious thinking mind assumes control; or in other words, the positions of the minds are reversed.) Is this theory considered valid?

G. A. Schnably, Jr.
Argyle, Texas.

(We are not at all sure whether you mean by "lunacy" a general or a particular type of mental disorder. Our dictionary at hand defines lunacy as:

"An intermittent form of insanity: Mental unsoundness in any degree, as distinguished from idiocy."

Now, we suppose, you mean by lunacy what is generally termed insanity, and even insanity takes many forms. One of the principal forms is "delusional insanity," which is the mental state of being possessed of delusions as to what exists around one and the motives of people toward one. "Paranoia" is another form, which is a general weakening of the mental powers. "Mania" is an extreme concentration of the mind on a particular subject or fancy. "Melancholia" is a state of extreme despondency; and "paranoia" is a chronic mental unsoundness, hereditary or acquired, which is sometimes associated with delusions.

As you can perceive, each of these things may arise from a different cause. The symptoms, and therefore the cure, may be greatly different. In any case, it is obvious that the conscious reasoning faculties are impaired, so that the sufferer is no longer able to reason sanely. In the case of paranoia, mania, and delusions, certainly the difficulty arises from some fear, or craving, or illusion arising from the subconscious mind to override the conscious mind. In that respect, you are correct.

In the case of dementia, there may result such a weakening of the general mental faculties that

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disease or imbecility will result. In this case the subject may reach that state you mention, of having practically no mind at all; in other words, there comes a general failnre of the mental faculties. This is technically known as "dementia praecox." As to the cure, we quote Dr. Bernard Hollander, who is an authority on the use of suggestion in tbe treatment of mental disorders. He says, in his work, "Methods and Uses of Hypnosis and Self-Hypnosis."

'Genuine mental disorders are most difficult to treat by suggestion or hypnosis. As a rule, only the early stages can be benefited. In the more advanced stages of mental derangement, we have to wait for the more or less lucid moments, in which the patient is receptive to other ideas than those which preoccupy him. We have to take care not to arouse his antagonism. In the milder form of melancholie, we may dissipate the anxiety and fears; in the early stages of paranoia, we may dispel the suspicions; and in dementia praecox, some good may be done and the progress of the disease arrested if the patient still has insight of his mental condition. Treatment of these disorders requires considerable patience and we must proceed cautiously. More promising is the so-called 'folie raisonnante' or reasoning mania, in which the patient questions everything, suffers from doubts, mental hesitation, and indecision.

"Among the minor mental troubles which can be treated hypnotically are obsessions. They consist most often of useless conscious ideas which occupy the mind of the patient to the exclusion of nearly everything else, and dominate his character and actions. In hypnosis we can bring the experiences, in which the fixed idea originated, before consciousness and dispel any anxiety connected with them."

In many cases where there is a struggle between the delusions of the subconscious mind and the reasoning faculties of the conscious mind, such a struggle could be won by the conscious mind by the help of simple, healthful surroundings, absence of any mentally depressing circumstances, and the appeal to the person by a clever psychologist. But try to train the mind of the patient into a cheerful and happy thought. Allowing him to occupy himself with the doing of simple and constructive things has also been found to be very beneficial.

As you can see, it is not possible to give one general answer to such a broad subject as that of insanity, or what you term lunacy. But we hope we have indicated some of the methods of procedure in this case, and would advise you, if you are interested in the subject, to follow it up by the reading of some good books on it, of which there are many. The book quoted is published by Macmillan & Co.—Editor.)

The Finite Universe

Editor, Science Questions and Answers:

Will you please answer the following question? What is meant by the expression "infinite but bounded" as applied to the universe?

Philip Bisson,
Baltimore, Maryland.

(We first consider what is meant by "the universe." In its original meaning, this means all space, and everything contained therein—the immensity of which was not realized, as shown by the fact that "the world" or its Greek equivalent, "cosmos", was often used in the same sense. At present "universe" is used by astronomers to signify definitely-bounded areas in the "cosmos" —as explained elsewhere in the answer to Mr. Baumgarten.

Einstein, however, is here speaking of the "cosmos," and applying its original meaning to the word "universe." He conceives of the universe as having properties like those of a closed curved surface [such as the inside of a sphere, with which we are familiar, but far more complex]. It is impossible to picture the idea; but it is clearly expressed in mathematical formulas. The conception thus described is that of a universe which has definite size; yet is limitless, because a boundary can never be reached.—Editor.)

Editor, SLOGAN CONTEST,
SCIENCE WONDER STORIES.
96-98 Park Place, New York City.

SEE PAGE 934
3-30

GENTLEMEN:

I have written below my entry in your $100.00 Prize Slogan Contest.

NAME

OCCUPATION .... *AGE*...............

STREET ADDRESS

CITY *STATE*.......................

The Reader Speaks

(*Continued from page 940*)

From a World Wanderer

Editor, Science Wonder Stories:

I have been in the Navy for some time and have seen quite a bit of the world. But I would rather take a trip in one of your interplanetary stories than any European or Asiatic cruise. The only reason I do not subscribe to your magazines is that we are constantly on the go, and it would take too long to have them forwarded to me. I can always dig down deep for your publications.

Chester G. Davis,
U. S. S. Contocook,
c/o Postmaster, New York, N. Y.

(We are glad to know that a world traveler as experienced as Mr. Davis finds our magazines of absorbing interest. His letter is an indication of the many types of readers who find intellectual stimulation in science fiction.—*Editor*).

One View of Dr. Keller

Editor, Science Wonder Stories:

I have been reading your magazine since it started. It is very good, but of course, not perfect. Nothing is perfect.

As to Keller: In the last five issues I have been amusedly watching the editors waxing enthusiastic about the "Human Termites." Well, I don't blame them. The editors have to praise a story to get the people to read it. But, Keller is "full of pink prunes." He's ridiculous. He's worse than that.

When Keller writes a story like the "Human Termites" and you print it, I give up in despair. Keller must be a dope fiend or an escaped maniac. There's a sanitarium out in Islip, Long Island, where they keep that kind of people. You better keep an eye on Keller. He may be dangerous.

Ants twenty feet long, central intelligences! Ha! Ha! Ha! Don't make me laugh. Oh, yes, Mr. Editor, there might be common earthworms six feet long and one inch thick. But, ants twenty feet long and central intelligences! Ha! Ha! Ha!

It's amusing to watch the gullible public swallow such a nightmare as the "Human Termites" and refuse to take "The Marble Virgin."

Glancing over January's issue "The Reader Speaks," I see Curtis Taylor's letter. Mr. Taylor reads SCIENCE WONDER STORIES and does not believe in evolution. Oh, Death, where is thy sting? Our religious Mr. Taylor believes that the world was made in six days. He thinks evolution means man descended from monkeys. Ignorance is bliss.

In conclusion, I want to say that you might have the magazine full of Keller's works and I would buy it just for the editorials. Good luck to Mr. Gernsback on his new venture, *Scientific Detective Monthly*.

Mr. Editor, keep Keller out of your magazines for six months and I will gratefully throw myself at your feet.

Morris Z. Ingher,
631 Crescent Street,
Brooklyn, N. Y.

(We print this letter without comment, except to refer the reader to the one following it, which gives another opinion on Dr. Keller).

Another Viewpoint

Editor, Science Wonder Stories:

I wish to get to the point very quickly, and will start in by saying that I know people less gifted than Dr. Keller who have had places in history. That man has a real mind and a real brain; as anyone can see by the various subjects he touches. In any case he merely scratches the surface of his knowledge.

There have been entirely too many people reading his stories who could not conceive of, nor in any way appreciate, his reasoned creations. Take it from me that I study the letters you receive for each issue, and I have come to blame Paul more than anyone else. That man can co-ordinate his art with his imagination so well that his covers attract too many "dumb doras" who are simply fascinated by them. They just buy the magazine and read it to verify their reactions.

If you printed your magazine with no illustrations, but with the same type of stories and authors, I wager that the discussion about authors being crazy would cease. I would then

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The Reader Speaks

(Continued from page 948)

have the pleasure of watching all your unappreciative readers recant their statements about David H. Keller. In his special writings he is the greatest author of all time, not even excepting the illustrious Gernsback.

Some people have no reasoning ability. Ninety per cent of the people are tolerably ignorant—not stupid, but ignorant. They cannot see the Bacons, Galileos, Newtons, Spencers, and Voltaires of today. The same rabble killed their greatest men and upheld their fanatics.

It's just like trying to put ten gallons of gas into a five-gallon tank to get them to appreciate Keller. I know that a good many real scientists appreciate him. I would like to get in touch with Dr. Keller personally. I feel that he is too sincere and too big to consider prostituting his ability to ulterior purposes.

Albert L. Simmonds,
714½ South Third Street,
Kelso, Washington.

(These two letters, one bitterly reviling Dr. Keller, and the other praising him to the skies, are prototypes of all the letters concerning the author of "The Human Termites." We find that no one can react in a half-hearted manner to Keller; he arouses either great admiration or bitter opposition. Some people think he is a genius, and some think he is mentally unbalanced.

We wish to call attention to the fact that every original mind in history encountered just this kind of opposition. Some people supported the great men from the beginning, and some fought them to the end—simply because of intellectual differences. One has only to call to mind such men as Mr. Simmonds mentions—Voltaire, Galileo, and others—Giordano Bruno, who was burned at the stake; Columbus, who was universally despised; and Socrates, who was forced to drink hemlock. Every pioneer in literature, art, and music received the same treatment. Wagner, the greatest operatic composer of all time, encountered fierce opposition almost all his life. Rodin, the sculptor, who is recognized now as one of the greatest, achieved recognition only in old age; Turner, the English painter who "captured sunlight" and devised a new method for painting it, died in poverty. We do not say that Dr. Keller ranks with these men of genius; but we do say that he has aroused the same sort of feelings, and if history means anything, we look to a repetition of it.—*Editor*).

More Fourth-Dimensional Stories

From St. Louis, Missouri, Claude Dames, of 5042 Northland Avenue, sends word that we should have more serials than we have now, and that we ought to devote more space to fourth-dimensional, futuristic, astronomical, and interplanetary stories. He seems to like our stories more than our other departments; for, although he approves of the "Science News" and "Science Letters" sections, he would be willing to forego the pleasure of reading these departments if he could have another short story in their stead.

Science and Religion

Editor, Science Wonder Stories:

Today is my sixteenth birthday. I am anxious to show my appreciation for the value I have received from this magazine by telling you one of the ways in which I have received benefit by reading it.

I go to church school at the First Unitarian Church, Cleveland. As you probably know, this church is extremely congregational. We believe that science is closely akin to religion. We are open to new ideas at all times and look upon religion with a most modernistic viewpoint. I cannot discuss in detail the phases of the church now, but what I want to say is that the class I attend at this church has chosen for its study "The Evolution of the Universe." SCIENCE WONDER STORIES has been extremely helpful to me, and the class as a whole. We have been able to obtain many facts from the "Science News" and "Questions" departments of your magazine in very compact and easily understandable form. The editorials by you, Mr. Editor, have indeed been of great value to us. From the stories themselves we have obtained facts of

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The Reader Speaks

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interest to our study. When we take up our next subject, "The Future Evolution of Man," I also shall expect to obtain most of my information from your magazine, which cannot be surpassed in value by any other so-called science fiction magazine on the market.

Allan P. Stern,
2995 Lincoln Boulevard,
Cleveland Heights, Ohio.

(This extremely interesting letter from this alert young man sums up in a nutshell the essential points of contact between science and religion. The church of which he is a member is fortunate in having as its minister the Rev. Dilworth Lupton, who has preached sermons on "Science and God," "A Religion Greater Than Christianity," and other such subjects. The world needs more men like Mr. Lupton who can co-ordinate the two great forces in modern life—science and religion—and who can show why they do not, and should not, conflict.—*Editor*).

Our Conquest Complex

Editor, Science Wonder Stories:

I feel that I must express my views on the utter absurdity of some of your stories. Can't your authors get a different theme than "conquering the world?" I never saw anything like it. In nearly all of your interplanetary yarns this is most prominent. I note twenty stories that you have published containing this theme (or a war theme of nearly the same order). Many of them were good, but the business gets on my nerves.

Can't some Martians come to the earth without trying to conquer it? Earth astronomers aren't trying to find life on Mars for the sole purpose of stamping it out. And what good does all this fighting do? You'll say there are reasons; perhaps the planet is overcrowded. Well, why not migrate peacefully? Do they always have to kill everybody? You certainly have a bloodthirsty set of authors.

Another thing I've noticed is that many stories have practically no plot. "The Ancient Brain" was one of the worst. "The Metal World" was an impossibility. As soon as the professor sees the Demetrians, he knows their names, how their rays work, where they come from, and everything about them. In less than no time, he has them conquered. Trash! And then some correspondent has the nerve to class Repp with Wells and Burroughs!

Please get better stories for the magazine, or you'll have lost a reader.

Robert A. Ward,
544 East 38th Street,
Baltimore, Maryland.

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The Reader Speaks

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(We have no conquest complex. The point is that our authors, far from being a bloodthirsty bunch of fiends, are hard-working, earnest, science fiction writers who are trying to produce good stories and who make use of the latest scientific developments to intensify the interest in their stories. As you will note, we are using fewer and fewer conquest stories that have no sound justification. Mr. Ward must remember also that new scientific devices often have to be explained in a war setting. It is more engrossing to read about the progress of a scientific war where scientific instruments are put to their most ruthless test than to read about a period of peaceful colonization. The latter idea is utopian; the former is what makes a story.

Our greatest reason, however, is founded on our knowledge of what war has been and what it will be like in the future. If, by picturing the devastation likely to accompany any future war, (each side equipped with scientific instruments) we can arouse the mass of the people to a realization of its horror, we think our stories will have amply served their purpose. As we have so often said, we have no propaganda; we are members of no cliques, parties or *isms*. But we believe that the horror of war is so universal that we cannot be accused of propaganda when we attempt to arouse opinion against it.

As to our stories having no plot, we feel we must disagree with Mr. Ward. We would never accept a story which did not possess a well-worked out and definite plot. If one re-reads the stories characterized as having no plot, we feel sure that what he formerly found missing will be found to reside in the stories.—*Editor*).

A Reply to Mr. Taylor

Editor, Science Wonder Stories:

In your January issue appeared a communication from one Curtis Taylor, of Utica, N. Y., who saw fit to condemn a certain story because it did not coincide with the biblical account of creation.

Mr. Taylor's letter would be amusing were it not evident that he really believes what he says. Not only does he deny evolution, but he considers the Bible a divinely inspired book—authentic, infallible, and unimpeachable! Such notions might be expected from a benighted hill-billy; but never from a person pretending to any degree of intelligence.

It is needless for me to refute his diatribe against evolution; that was admirably attended to by the editor. Nor is it my purpose to alter Mr. Taylor's dogmatic religious beliefs. I must protest, however, against his absurd criticism of scientific stories. According to his ideas, all fiction that does not jibe with holy writ should be placed on the Index Expurgatorius. He even threatens you, the editor, with a loss of circulation if you don't stop printing such wicked, ungodly tales!

Really, some one should inform Mr. Taylor that his precious Bible is on a par with the Arabian Nights, only less interesting. It is no more sacred than a cook-book, and far less useful. It is full of myths and contradictions—not to mention obscenities. Its sole value is to reveal the ignorance of its writers—and to provide a living for the clergy. Otherwise it's a dead loss.

Allen Glasser,
981 Forest Avenue,
New York, N. Y.

(Several readers have written in to protest vigorously against Mr. Taylor's rather uncompromising assertions concerning evolution and the Bible. It is not our purpose to interfere with anyone's religious beliefs, but we feel that the Biblical account of the creation does not correspond with the findings of many of our greatest scientists.

Mr. Glasser's vigorous attack on Mr. Taylor errs in one respect. The Bible is not by any means a dead loss. The King James version is one of the greatest pieces of English literature, and it has been the model for many of our greatest prose writers. While we do not accept the statements in the Book of Genesis, we prize the Bible for its great literary value and for the profound psychological truth of many of its assertions. It happens far too often in our present era of religious skepticism that we are apt to sweep aside everything relating to the past as

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The Reader Speaks

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to look upon only what is new, modern and scientifically proved as being of any value. Therefore it has become quite fashionable to speak contemptuously of the Bible. While most scientists assert that the Bible is not a scientific textbook of geology or biological evolution—those who are broadminded and free from partisanship recognized that it is a monumental work of inestimable moral, historical and literary value. And as such, they feel, it is entitled to the highest consideration.—*Editor*).

One Vote for "Science Club."

Editor, Science Wonder Stories:

Here's to the success of your magazine, old man. I have enclosed check for one year's subscription.

Before closing this brief letter I would like to ask you a few questions. Why not have a "Science Club?" If in doubt as to its popularity why not hold a vote? Here is:—

Vote No. 1

Then also why not have a second editorial containing the percentage of Fact, Theory, and Fiction in each story? It would satisfy my parents' doubt as to the literary value of the magazine.

Wishing you trainloads of success and "Not a Cough in a carload."

Walter Hausy
Richmond Hill, N. Y.

(The idea of the Science Club proposed by Mr. Hausy will be taken under consideration. Regarding the literary value of the stories, Mr. Hausy need only refer his parents to our board of associate editors, some of the more prominent scientists and educators in the country. With the help of these men we are giving our readers not only a tremendous amount of entertainment and stimulation but also a *scientific education in itself*—*Editor*).

Dr. Keller's Oversight

Frank Lamia, of 858 Cass Street, Milwaukee, Wisconsin, writes in to say that Dr. Keller has overlooked several instances in his stories of the "Human Termites" and "The Conquerors." He mentions poison gases and bombs which might have destroyed the termites, and airplanes which might have attacked them from the air. He suggests that steam rollers could have demoralized the marching ants, and that "death rays" would have worked havoc among them. In the same way, Brunton, in "The Conquerors," could have put a quantity of slow-acting poison into the magic fluid with which all the persons of the lower world were inoculated.

The Fitzgerald Contraction

Editor, Science Wonder Stories:

After months of delay I have at last come to tell you how much I like your SCIENCE WONDER STORIES. I have been reading them with the greatest interest since they were first published. I consider the "Conquerors" one of the finest stories that you have published up to date. However, don't let Dr. Keller off with that story. Make him write a sequel to it. I am burning up with interest to know the results of the Conquerors' interplanetarian explorations. By the way, what has happened to Ray Cummings? Get him on the job to write some stories for the magazine. And then get a few of A. Hyatt Verrill's stories and print them. As a whole, your stories have been very good—only make your authors dispense with war and such stories which end with the main character in some other plane. Keep Pratt and Lester working. They are fine. I can't say enough for Drs. Keller and Breuer. How about an occasional story by Edgar Rice Burroughs and a reprint from Jules Verne?

As the final Parthian shot I might say that your columns in the back of the magazine are fine. And before I forget it is the V in the equation $L = \sqrt{1 - V^2}$ a variable whose limit is one? I liked the Fitzgerald Contraction very much.

W. Wright,
1515 Oneida Street,
Utica, N. Y.

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The Reader Speaks

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(Many readers are asking for stories by the popular authors mentioned. We may have something interesting to say to them in the near future.

The equation is $L_1 = L\sqrt{1 - V_1^2}$, and is, of course, the famous Lorentz-Fitzgerald equation.

$$L_1 = L\sqrt{1 - \frac{V_1^2}{C^2}}$$

where C is the velocity of light L is the original length of rod, and L_1 its length when traveling at velocity V_1. However, the V in the story is in reality $\frac{V_1}{C}$. When $\frac{V_1}{C} = C$, then $\frac{V_1}{C} = I$, and so $L_1 = 0$.—*Editor*).

Our Educational Effect

Editor, Science Wonder Stories:

I want to say something about your wonderful magazine, which is wonderful because there is no other that so expertly blends science and fiction. Also—it constantly makes me want to increase my knowledge of astronomy and evolution. I was very much interested in Curtis Taylor's letter in the January issue. Your comments on it were splendid. The letter, it seems to me, was distinctly sarcastic and lacking in ordinary intelligence. Evolution is not a theory. It is a solid fact. Proof of this is evident everywhere. If Mr. Taylor will devote a little time to the study of it, I feel sure he will soon realize how plausible it is.

Dr. David Keller has been my choice of authors for some time. However, I was extremely disappointed in "The Human Termites." I don't think I can say one good thing about it. I was amazed that Dr. Keller would so insult human intelligence and credit the termites with an intelligence superior to any others. What great things did the termites accomplish? None. They merely discovered a way to breed rapidly. They had nothing to compare with the wonders of our civilization, and so they wished to destroy it all. The story was morbid, and I hope Dr. Keller will soon write another with the amusing charm of "The Feminine Metamorphosis."

In reading your magazine I am always conscious not only of much pleasure in its fine contents, but also of unlimited educational benefit. Your other departments are excellent. Of course, you can't please everyone, as the letters show, but you are making a wonderful effort to accomplish that very thing.

Mrs. Olive Mae Skinner,
1726 Purchase Street,
New Bedford, Mass.

(In his introduction to "The Human Termites," Dr. Keller referred to Maeterlinck's book, "The Life of the White Ant." In this

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The Reader Speaks

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volume the interested reader will find an amazing number of scientific facts concerning the termites. What these blind white ants perform may seem to us to be miracles. They can breed warriors or workers, as they choose; they can select, as if guided by some uncanny intelligence, the weakest point in a wooden structure, and bore through it there, so that the structure collapses at the first touch; they can cover up the holes they have made so that human beings will be unaware of them for years.

Dr. Keller was by no means drawing upon his imagination when he described the intelligence and activities of the termites. Everything he recounts is scientific fact. The only imaginative part of his story is, of course, the development of termites twenty feet long; and this is not an impossibility. It is possible for them to develop to an amazing degree. We ourselves can change the racial characteristic of infants in our laboratories. We can change the characteristics of insects and evolve new species. Termites as large as those in the story are not impossible for the reason that, if their development were required by natural circumstances, they would attain that size. There existed on the earth creatures much larger than the twenty-foot termites; and these creatures may have their counterparts at some time in the future. Evolution is still going on.—*Editor*).

More Short Stories

O. L. Beckwith, of Ovid, Michigan, writes to complain of the relatively few short stories in our magazines. He will sacrifice any other feature for more short stories—and he will accept no compromise. He thinks the stories as we publish them would be improved by the omission of the little editorial notes on the first page of each, and by the omission of the sub-headings. These points have been stressed by other readers, and perhaps we may act upon them.

Look at Them Now!

"Look at them now!" says Harry Feinstein, of 365 East 2nd Street, Brooklyn, New York—referring to the state that our scientific magazines have come to. We started out splendidly, according to Mr. Feinstein, but at the present time our stories are not stories at all, but just ideas. For example, the writer mentions "The Vapor Intelligence." He discredits sweepingly all time traveling by saying that it is impossible, but that we might be able to construct a machine to catch light waves, so that we may see past events—but not future ones.

A Summing Up

Editor, Science Wonder Stories:

I am glad to say that your January issue is up at the top of the ladder. "The Fitzgerald Contraction," by Miles Breuer, was very good. "The Red Dimension" was a close second and the end of "The Conquerors," by Dr. Keller, was also good. I am sorry to say that "The Vapor Intelligence" was not very good.

There is one sentence in "The Conquerors" which I agree to, but do not know if Dr. Keller had the same thought in mind when he wrote it, as I had in reading it. Namely, "I want you to remember that, only rarely, in handling people of unusual intelligence, is it necessary to shoot." What does Dr. Keller mean by that? That such people would stop first and reason, before doing injury? That is my conclusion and I am wondering if that was the author's.

One other thing, I wish to thank you for publishing Mr. Curtis Taylor's highly amusing conception of evolution. It sure was great! If Mr. Taylor would spend a little of his time in learning the true facts of evolution, it would be better for him. Mr. Taylor is evidently a religionist, a strict religionist, who makes the common error of speaking without knowing what he is saying.

Harold L. Rakoczy,
2117 North Broad Street,
Philadelphia, Pa.

(Dr. Keller, we believe, means just what Mr. Rakoczy thinks he means. When dealing with an unreasoning being it may be necessary to use force. But with intelligent people reason and logic are generally all that is necessary to achieve an objective. Concerning Mr. Taylor, we have said enough elsewhere. This letter speaks for itself.—*Editor*).

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The Reader Speaks

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Lectures on Astronomy

Editor, Science Wonder Stories:

I feel it is about time I put in my word or two. I am only eleven, but I have been reading your science fiction magazines since June, 1927. I can safely say that since then I have only missed two editions of the magazines you edited.

I am in favor of the "Science News" department. I am often called upon to give lectures before the class on Astronomy, etc., and they never believe me when I tell them that I got my knowledge from Science Fiction.

Eugene Cooper,
Hollywood, Calif.

(Mr. Cooper must have really soaked up all the available knowledge contained in our stories. That is what we are gratified to hear. It gives us the certainty that what we are trying to do —to educate as well as entertain—is successful. Mr. Cooper will find that in five years he will have a scientific knowledge that many men years older would be glad to have.—*Editor.*)

A "Brick Batter" Per Our Request

Editor, Science Wonder Stories:

I have just finished reading my first issue of your magazine. The department called "The Reader Speaks" particularly interested me. This department, by the way, is a most unique and attractive feature. Your magazine would lack a personal touch if it were to be discontinued.

I notice in particular that the editor requests some more old-fashioned "brick hats." Well, that is the important reason for writing this letter. This letter will contain a good many "brick hats" and I would like to see it published so that I can find out how many readers agree with me on the several faults of the magazine as I see them.

One fault is the scientific articles. I do not doubt for a moment that it is good authentic reading matter, but I doubt the advisability of the editor in placing it in a magazine like SCIENCE WONDER STORIES. These are reasons upon which I base my conclusions.

It is entirely too long. The space occupied by it might well have been used to better advantage. Think of the short stories that might have been printed in its place! To me it is pure waste, for I have not found it interesting in the least.

In a magazine devoted almost exclusively to fiction, it is singularly out of place. It ought to have been published in some other magazine.

For goodness sake, never attempt to print anything else like it. I want *Science Fiction*, and I intend to get it.

Personally, I don't like "Science News of the Month" either. If I want science news, I intend to get it from scientific journals and not from SCIENCE WONDER STORIES.

Now Mr. Editor, I hope you won't cry for more brick bats. If you do, I'll send you a good one next time. But I really think your magazine is splendid, with the exceptions of the above statements.

I want every SCIENCE WONDER STORIES reader who is interested in formulas of any kind to send me his or her name and address. I myself am greatly interested in formulas and would like to know the proportion of this magazine's readers that is interested in them. Formulas are exceptionally interesting, especially to a science fiction fan. Please send your name and address as soon as possible. I shall be very glad to hear from other readers of "our" magazine.

Neil H. Tasker,
Shamokin, Penna.

(We are very glad that our request for brick bats evoked such a prompt and hearty response as in this letter from Mr. Tasker. He will note that the present issue contains quite a number of improvements.

Regarding scientific articles and "Science News of the Month," we have received quite a number of partisan letters, pro and con. The great majority, however, favor both of these and as we are trying to please the majority, we feel gratified that we did.—*Editor.*)

Book Reviews

CHEMISTRY IN DAILY LIFE, by Samuel Glasstone, D.Sc., Ph.D., F.I.C. 250 pages, illustrated, stiff cloth covers, size 5" by 7½". Published by E. P. Dutton & Company, New York. Price, $2.25.

This intensely interesting book gives a comprehensive survey of the part that chemistry plays in the modern world—not only in the field of industry and science, but also in the home, and, indeed, everywhere man goes. Some parts of the book were presented first in the form of radio lectures, and attracted a great deal of attention among scientific men and among laymen. This volume traces the beginnings of chemistry, and gives comprehensive views of the latest developments in electricity, chemistry, food research, oxygen, plants, fuels, metals, industry, and medicine. The book is excellent for use as a text; and, at the same time, it makes fascinating reading for the average person interested in the vast development of the science of chemistry.

SUNRAYS AND HEALTH, by Ronald Millar, in collaboration with Dr. E. E. Free. 125 pages, stiff cloth covers, size 5¼" by 7¾". Published by Robert M. McBride and Company, New York. Price, $1.50.

In this little volume, the authors clear up several misunderstandings about the curative value of sunlight. The popular mind has been filled with exaggerations concerning the value of sunrays—chiefly through high-powered advertising. This book, while it tells all the possible values of sunlight treatment, also tells one what to avoid; and in this respect it is valuable. Sunlight, from ancient times to now, has been the power that runs the world. Its value, if it is used rightly, cannot be overestimated; and *Sunrays and Health* will enable the average person to get the most benefit from the source of all power.

THE STORY OF EVOLUTION, by Benjamin C. Gruenberg. 473 pages, illustrated, stiff cloth covers, size 6" by 9". Published by the D. Van Nostrand Company, New York. Price, $4.00.

The field of evolution has been covered so often that it is refreshing to find a book like *The Story of Evolution*, which makes the subject a great deal more interesting and at the same time presents a solid amount of scientific information. The author is a specialist in biology, and his distinctions between scientific and unscientific ideas of evolution are unusually illuminating. He does not confuse the facts with the theories, and in this respect alone the book is valuable. Fully half the book is given over to observed facts, before the theories are discussed. The unusual illustrations and photographs give the work a great deal of value for the student and for the general reader who wishes to see the tangible evidences of evolution.

THE WONDERFUL STORY OF SCIENCE, by Inez N. McFee. 398 pages, illustrated, stiff cloth covers, size 5½" by 8". Published by the Thomas Y. Crowell Company, New York. Price, $2.50.

In this book Mrs. McFee, well known for her writings on popular science, succeeds in compressing the entire story of the world's scientific progress into a single remarkable volume. She takes up in turn the story of the stars, the story of the earth, the story of plant life, the story of animals, the story of man, the story of chemistry, the story of sound, heat, and light, and the story of electricity. Under these collective titles she gives swift-moving pictures of biology and evolution, physics, astronomy, geology, and the other major sciences. The book is very well illustrated with excellent photographs and drawings, and the number of interesting and pertinent subjects it covers is nothing short of amazing. One learns of the first man, and may range from the crudities of that remote time to the radio he uses every day.

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Book Reviews

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THE OUTLINE OF SCIENCE, edited by Professor J. Arthur Thomson. Four volumes, 1220 pages, profusely illustrated with many plates in color. Stiff cloth covers, size 7½" by 10½". Published by G. P. Putnam's Sons, New York. Price, $18.00.

This great work, first published in 1922, is still one of the most popular scientific encyclopedias in the world. This is all the more remarkable; in view of the fact that, with new discoveries taking place so frequently at the present time, and with new developments being made in all the important sciences, it is still up-to-the-minute in its information. This is because the information contained in it allows for the development that has taken place in science since the time the volumes were published. The value of *The Outline of Science* lies also in the fact that it is an entirely intelligent presentation of all important scientific knowledge; that it covers every branch of science, from astronomy to zoology, in which the average person and the student are interested; and that the manner of its presentation is such that the facts remain fixed in memory.

A valuable feature of this great work is the number of photographs and drawings with which it is illustrated. There are more than 800 illustrations in the four volumes, and the colored plates—such as those illustrating the sun and its heat and light radiations—are superb. The universal praise that *The Outline of Science* has drawn from authorities is assuredly deserved. The *London Morning Post* sums up the consensus of opinion by saying that it is "So accurate that the expert cannot cavil at it, and so simple that the general reader, who has no time for special study, can understand it." A great deal of praise must also be given to Professor Thomson, who, with other eminent scientists, has produced a work nothing short of monumental.

SCIENCE AND THE UNSEEN WORLD, by Arthur Stanley Eddington, F.R.S. 91 pages, stiff cloth covers, size 5" by 8¼". Published by the Macmillan Company, New York. Price, $1.25.

Dr. Eddington is one of the world's foremost scientists. *Science and the Unseen World*, delivered first as the Swarthmore Lecture, tries to correlate known physical facts with things unseen which we believe to be facts. In other words, Dr. Eddington tries to link up the facts of evolution with the Bible; the laws of the universe with the idea of a Divine Being. In this attempt, he goes into the consciousness of man; and shows the relevancy of the application of "natural law" to some spiritual phenomena. The book is fascinating, and an important link in the strengthening bonds between science and religion.

TWO THOUSAND YEARS OF SCIENCE, by R. J. Harvey-Gibson, D.Sc., F.R.S.E. 362 pages, profusely illustrated, stiff cloth covers, size 5½" by 8¾". Published by the Macmillan Company, New York. Price, $4.00.

Professor Harvey-Gibson is well known for his academic and research work, as well as for the many books he has written. This book sums up in one volume the many fields in which he has been active. The book is a veritable encyclopedia of scientific facts, arranged in story form in the order of their discovery. The great scientific figures of the world add to the pages a great deal of interest.

The author treats of "the wonders of nature and their discoverers." He covers with fascinating chapters, and illustrates with more than 100 drawings, the birth of science; science in the Middle Ages; the discoveries of science to the end of the seventeenth century; and science in the eighteenth and nineteenth centuries and in the present day. His history covers the fields of physics, biology, chemistry, astronomy, geology, paleontology, anthropology, and their allied subjects. We know of no better way to gain a clear perspective of the development of science through the ages than by a careful reading of *Two Thousand Years of Science*.

(Continued on page 957)

BOOK REVIEWS

(Continued from page 956)

YOUR NOSE, THROAT AND EARS, by L. W. Oaks, M.D., and H. G. Merrill, M.D. 167 pages, illustrated, stiff cloth covers, size 7½ by 5. Published by D. Appleton and Company, New York. Price, $1.50.

In this volume the authors present a detailed view of the structure of the nose, throat, and ears, showing their interrelation and the effects of various pathogenic organisms upon each. In addition, there is a very practical discussion of the common cold, which includes not only a description of the reasons for the infection but, what is more important to most of us, a discussion of the various methods for overcoming it. From the practical viewpoint, the book is a helpful addition to any health library.

SCIENCE IN THE HOME, by Nathan B. Giles and Dorothy G. Ellis. 161 pages, stiff cloth covers, size 5¼ by 7¾. Published by John Wiley & Sons, Inc., New York. Price, $1.50.

Science in the Home deals with the practical problems faced by the housekeeper and home owner. It deals with such important subjects as the scientific care of foods, the scientific care of the health, the scientific purification of water, the application of science to the problems of lighting, heating, and ventilating the home, and its use in maintaining a hygienic condition in regard to the disposal of various wastes. As a text-book, the volume is excellent, and it is very useful as well for the housekeeper who wishes to maintain in her home the highest possible state of family health.

FORTUNA, OR, CHANCE AND DESIGN, by Norwood Young. 93 pages, stiff cloth covers, size 6¼ by 4¼. Published by E. P. Dutton & Co., New York. Price, $1.00.

This little book by a well-known scientist propounds the intensely interesting question: "Is the universe a product of chance or of design?" The author begins at once with a terrifically large subject—but he does not confine himself to human affairs alone. As a result, his analysis embraces a scope much greater than the ordinary books on the subject; and it achieves an interest which few volumes are able to attain in so limited a space.

FOUNDATIONS OF THE UNIVERSE, by M. Luckiesh, D. Sc. 245 pages, illustrated, stiff cloth covers, size 8½ by 5¾. Published by the D. Van Nostrand Company, New York. Price, $3.00.

This book presents an interesting and popular treatment of the basis of all the sciences—physical science. Dr. Luckiesh deals entertainingly with the theories of matter, with atomic, molecular, and electronic structure, with space, light, the Einstein theories, the quantum theory, and with the other important developments in the particular field of science he presents. An acknowledged authority, he has written a book which does not have recourse to mathematics, and which is, therefore, all the more interesting to the average person because of that.

CANCER, by Albert Soiland, M.D. 143 pages, illustrated, stiff cloth covers, size 5 by 7½. Published by D. Appleton and Company, New York. Price, $1.50.

Cancer is called "a professional responsibility and a public liability." This book gives valuable information which will save many lives. The known methods of preventing and treating the dreaded disease are presented in language suitable for the person with no technical education. The author, a well-known medical authority, gives some of the wrong ideas concerning cancer, and describes the quack "cures." *Cancer* is an important book in that it deals thoroughly with a disease which takes thousands of lives yearly.

THE MIND AT MISCHIEF, by William T. Sadler, M.D., F.A.C.S. 400 pages, stiff cloth covers, size 6 by 9¼. Published by the Funk and Wagnalls Company, New York. Price, $4.00.

"The Mind at Mischief" deals with a particularly interesting subject—the tricks and deceptions of the subconscious mind. It considers also the illnesses which the "psychic twists" to which these tricks lead, and, most important of all, it tells how one may deal with them. To delve into the hidden depths of one's own mind is fascinating; and this book, which leads the reader through the mazes of the subconscious, assists one to understand better than before the workings of his own mind and consciousness. Dr. Sadler has been engaged in investigating the subconscious almost for a quarter of a century, and his statements have the stamp of authority. The reader will find a great deal of help in this most interesting volume.

YOUR NERVES AND THEIR CONTROL, by Foster Kennedy, M.D., F.R.S., and Lewis Stevenson, M.D. 173 pages, illustrated, stiff cloth covers, size 5 by 7½. Published by D. Appleton & Company, New York. Price, $1.50.

A book on nerve control is of especial value at the present time, when there is so much misunderstanding prevalent concerning the function and control of the nerves, and when terms like "complexes" and "repressions" complicate the matter. The authors, specialists in neurology, present a simple outline of the structure and function of the nervous system, and then lead the reader into an understanding of the part that physical facts play in nerve control. While nervousness is often an indication of organic disease, the fact remains that, in many cases, treatment of the nerves themselves is highly successful, especially from the viewpoint of the emotional person; and this book will be of great assistance to those who suffer from any type of nerve ailment and who wish to understand the cause of their illness.

A HANDBOOK OF THE DRAGONFLIES OF NORTH AMERICA, by James G. Needham and Hortense Butler Heywood. 378 pages; illustrated; stiff cloth covers; size 9¾ by 6½. Published by Charles C. Thomas, Springfield, Illinois, and Baltimore, Maryland. Price, $7.00.

This book deals exhaustively with the subject indicated by its title. When one considers the vastness of the insect world, and the almost incredible number of species, he will realize the great amount of research and experiment conducted by the authors. While the volume is primarily technical, for students of natural history and for collectors of dragonflies, it is also interesting to others who wish to know more abut a fascinating family of the insect world.

WHAT EVERYONE OUGHT TO KNOW, by Oliver T. Osborne, M.D. 313 pages, stiff cloth covers, size 8 by 5¼. Published by Charles C. Thomas, Springfield, Illinois, and Baltimore, Maryland. Price, $2.50.

This health book is one of the most practical and valuable we have seen for some time. It does not devote itself to theories, but deals with the every-day problems that present difficulties for most people. For example, many of us would like to know what is the best type of toothbrush for certain types of mouths; or what to do for an unconscious person; or what effect tobacco has upon the system in general. This book is one which answers just such questions, and numerous others. It gives the information one wishes on pertinent health points, and at the same time it outlines a general regimen of diet, exercise, play, and sleep which is designed to bring health to the person following it. We can recommend this volume without reserve as one of the best of its kind.

(Continued on page 958)

BOOK REVIEWS

(*Continued from page 957*)

INDUSTRIAL EXPLORERS, by Maurice Holland. 347 pages, illustrated, stiff cloth covers, size 8¾" by 5¾". Published by Harper & Brothers, New York. Price, $3.00.

"Industrial Explorers" is a fascinating account of some of the outstanding industrial scientists in the United States. Written by a man acquainted with all the people of whom he writes—a director of the National Research Council—the book is authentic in its biography, and absorbing in its descriptione of scientific investigations. Mr. Holland gives intimate word-studies of such inventors as Elmer A. Sperry, whose gyroscope stabilizer has become standard; L. H. Baekeland, whose company produces bakelite, and others. All told, there are nineteen portraits, covering every phase of industry, from scientific food production to aviation. "Industrial Explorers" is assuredly one of the most interesting hooks in its particular field.

THE ELECTROMAGNETIC FIELD, by Max Mason and Warren Weaver. 390 pages, illustrated, stiff cloth covers, size 7" by 10". Published by the University of Chicago Press, Chicago. Price, $6.00.

This is a volume intended for the use of advanced electrical studente and electrical engineers. The entire book is a detailed study of the application of mathematics (particularly of vector analysis) to the electromagnetic field. It is the result of five years of work by its eminent authors, and it ie the only book of its kind in English. "The Electromagnetic Field" is in no sense a work for the amateur electrical experimenter; to be able to understand it, one must be a trained ecientist and mathematician. We take pleasure in recommending to euch technical experts a volume which is truly monumental.

THE ADOLESCENT, HIS CONFLICTS AND ESCAPES, by Sidney I. Schwab, M.D., and Borden S. Veeder, M.D. 365 pages, stiff cloth covers, size 5½" by 8¼". Published by D. Appleton and Company, New York. Price, $3.00.

This book, written by two well-known medical authoritiee, is the result of many years of investigation and research. It deals in detail with the period leading up to adolescence, with adolescence itself, and with its consequencee. It stresses especially the neurological aspect of the subject, which is becoming more and more important. The question of sex, with regard to the young, receives a very sane treatment, and the pitfalls of youth are clearly distinguished. Parents and teachers will find thie book unusually helpful; for it deals with problems with which they are faced every day.

ROMANCE OF THE PLANETS, by Mary Proctor, F.R.A.S., F.R. Met.S, 272 pages, illustrated, stiff cloth covers, size 5" by 7½". Published by Harper & Brothers, New York. Price, $2.50.

Miss Proctor has written several books on popular astronomy; the *Romance of the Moon* and *Romance of the Sun.* In this latest volume, the author gives each planet of the solar system a distinct personality, making clear the characteristics which distinguish it from the others. There are fascinating chapters of speculation as to the possihility of life on other planets, and as to the types of life that are likely to exist on them. The romance of astronomy is intensified by the story, retold here, of its development from astrology. One of the most valuable features of the book is the conception it gives of the incredible vastness of epace, of the terrific speed of cosmic motion. Above all, one is conscious that all the planets in their orbits are governed by the same laws—a thought that hrings home vividly the conception of the terrific scheme of things that is the universe.

LOVE AND MARRIAGE, by Winfield Scott Hall, M.D., Ph.D. 367 pages, illustrated, stiff cloth covers, size 5½" by 8¼". Published by the John C. Winston Company, Philadelphia. Price, $2.00.

This book, hy the famous author of "Sexual Knowledge," which is very well known, takes a sane attitude on one of the most important questions of the preeent day. Social conditions having changed to no small extent during the past decade, some vital customs have changed with them; *Love and Marriage* is intended eepecially for the modern young person on the threshold of matrimony. Dr. Hall, giving full explanations of the development of the sex urge and the sexual organs, and assuming always a scientific attitude, nevertheless manages to combine the facts with an idealism that is valuahle. Young people are no longer ignorant of the mysteries of sex; but their ideals have not kept pace with their knowledge; and the present volume succeeds in bringing about a sane adjustment between the moral aud physical forces in the life of man.

THE FUTURE OF THE EARTH, by Harold Jeffreys, Ph.D. 79 pages, stiff cloth covers, size 6¾" by 4¼". Published by W. W. Norton & Company, New York. Price, $1.00.

This volume, an addition to the popular "New Science" series, is the work of a world-famous geophysicist, who has carried even farther than Sir James Jeans the tidal theory of the origin of the earth. Dr. Jeffreys deals with the future of the earth, the eun, and the moon. In three sections he analyzes the various theories concerning the origin of these three bodies, and prophesiee, a billion years from now, the freezing of the oceans.

KEEPING YOUNG AFTER FORTY, by Eugene Whitmore. 207 pages, stiff cloth covers, size 7½" by 5¼". Published by D. Appleton & Company, New York. Price, $1.50.

Dr. Whitmore, well known ae a dietitian and as an authority on health, presents, in this hook, a very rational method for retaining health and vigor after the crucial point in middle age. Diet, sunlight, hygiene, the care of special organs, recreation, prevention of communicable diseases—all these are treated in a thoroughly practical menner. The author has worked for years with the United States Army, and his practical experience is immense. He suggests no rigorous treatments but, on the contrary, he advocates the assistance of nature by means which cannot be considered artificial. He stresses the value of mental health, the value of play, the health value of freedom from worry. The chapter on the "Hygiene of the Nervous System" will he especially interesting to women past forty.

THE RIDDLE OF SEX, by Dr. Joseph Tenenbaum. 362 pages, stiff cloth covers, size 5¾" by 8¾". Published by The Macaulay Company, New York. Price, $3.50.

This is a very thorough work, dealing with every phase of normal eex life and with some of its abnormal phasea; yet written in non-technical language easily comprehended by the person unacquainted with medical terms. Dr. Tenenbaum is well known as a scientist and as an author of books in several languages; and *The Riddle of Sex* presents much of physiological fact with the minimum of theory. The author traces the development of the sexual impulse in male and female adolescents; he follows it on through marriage and hirth, and touches on the dark chapter of sex perversion, which is one of the hidden causes of unhappiness in many marriages. Dr. Tenenhaum gives also a sane treatise on venereal diseases. Assuredly, his book ehould be read hy all thoee who wish to gain a clear and comprehensive knowledge of a most important subject.

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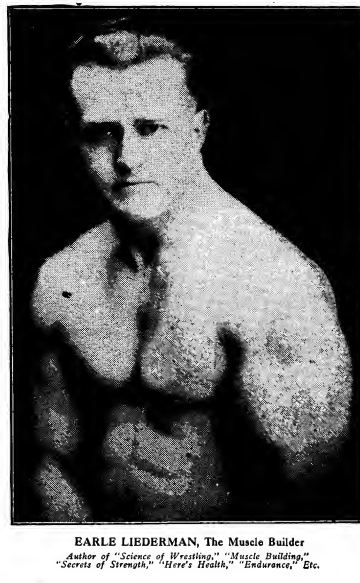

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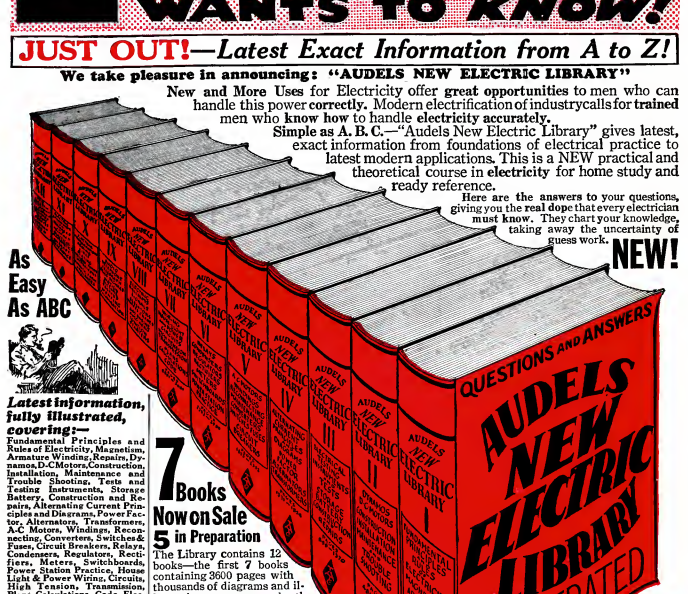

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